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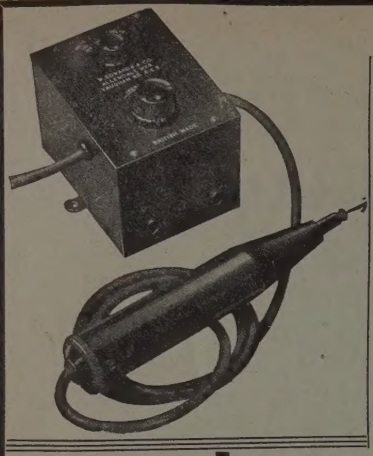

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NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers. (An abridged version of the U.D.C. accompanies the Annual Index.) An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, " : " e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

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026 : 061.3 *see Abstr.* 1

061.3 : 026 1

Association of Special Libraries and Information Bureaux. Annual conference. *Nature, Lond.*, **156**, 605–7 (*Nov.* 17, 1945).

MATHEMATICS 51

511.26 2

New types of relations in finite field theory. VANDIVER, H. S. *Proc. Nat. Acad. Sci., Wash.*, **31**, 189–94 (*July*, 1945).—A continuation of previous work [Abstr. 1605, 1179 (1945)]. The new types of relations concern the number of solutions of the equation $x^m = by^m + 1$ in a finite field of order p_{2n} where p is prime. L. S. G.

512.31 3

Rapid least-squares solution of polynomials. BIRGE, R. T., AND WEINBERG, J. W. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 106 (*Aug.* 1 *and* 15, 1945).—By means of a modification of Tchebycheff's recursion formula, explicit expressions have now been obtained for all R_{kt} functions needed in the case of polynomials of the 10th or lower degree. These confirm published results of F. E. Allan, who based his work on a different formula. A general expression has been derived for $t!a_{tt}$ in the form of a weighted average of the finite differences $\Delta^t y_l$, for any value of t. Tables of values of the required weight of each $\Delta^t y_l$ were calculated for $t = 1$, 2, 3 and 4, and for n (= number of observations) up to 20.

512.31 4

Probable errors for least-squares solutions of polynomials. WEINBERG, J. W., AND BIRGE, R. T. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 106 (*Aug.* 1 *and* 15, 1945).—A general expression was obtained for the weight N_t of the final coefficient a_{tt} of a polynomial of degree t. A set of such coefficients (with $t = k$ to j) is required for the evaluation of each coefficient a_{kj} of the jth-degree polynomial. Due to the orthogonal character of the solution, the various members a_{tt} of such a set act like independently observed quantities, and this fact was explicitly proved. Hence the law of propagation of errors can be applied to any function of the a_{tt}, including the expressions for the a_{kj} and for the function itself. Thus an explicit expression for each desired probable error is obtainable. The value of $\sum v^2$ (v = residual) for the jth-degree polynomial, needed in the calculation of the various probable errors, is given by the formula $\sum y^2 - \sum_{t=0}^{j} N_t a_{tt}^2$. Tables of numerical values of N_t were calculated, for $t = 0$ to 5, and for n up to 20.

512.52 5

Formulas for complex interpolation. LOWAN, A. N., AND SALZER, H. E. *Quart. Appl. Math.*, **2**, 272–4 (*Oct.*, 1944).—An analytic function of $z = x + iy$ is approximated by a complex polynomial of degree n, $f(z) = A_k(P)f(z_k)$, passing through $n + 1$ points equidistantly spaced along a straight line in the z-plane. Tables are given of the real and imaginary parts of the coefficients $A_k(P)$ where $P = (z - z_0)/h$ and $h = p + iq$ is the complex tabular interval. The cases dealt with are $n = 2$, 3, 4 and 5. L. S. G.

512.831 6

Expansion of determinantal equations into polynomial form. WAYLAND, H. *Quart. Appl. Math.*, **2**, 277–306 (*Jan.*, 1945).—A critical comparison is made of the various methods available for expanding equations of the form

$$|A_0\lambda^n + A_1\lambda^{n-1} + \ldots + A_n| = 0$$

where $A_0, \ldots, A_n$ are square matrices of order m. Numerical examples are given and the most important methods are described in sufficient detail to aid the computer. The number of operations required to reach the polynomial form is computed for each method, and this enables a computer to decide on the best method in a particular case. A valuable bibliography is given. [See Abstr. 772 (1944)]. L. S. G.

512.99 = 69 7

Example of an algebra which admits a particular type of involution. GOMES, R. L. *Gazeta de Matematica*, **6**, 1–3 (*Feb.*, 1945).—An involution, J, within a linear algebra or hypercomplex number system, A, is defined and some theorems relating to J are established. The particular type of involution considered is one whose symmetric elements [a is symmetric if $a = J(a)$ where $a \varepsilon A$] are the elements of a certain field. L. S. G.

512.99 = 69 8

Algebras in involution. DE MIRA FERNANDES, A. *Gazeta de Matematica*, **6**, 1 (*May*, 1945).—An involution [Abstr. 7 (1946)] is considered and it is shown that every element a admits a decomposition $a = a' + a''$ where $a' = \frac{1}{2}\{a + J(a)\}$ is symmetric and $a'' = \frac{1}{2}\{a - J(a)\}$ is skew-symmetric. Various consequences of this result are examined. L. S. G.

517.63 : 536.21 *see Abstr.* 76

517.9 : 530.145 *see Abstr.* 16

517.944 9

The numerical solution of partial differential equations. EMMONS, H. W. *Quart. Appl. Math.*, **2**, 173–95 (*Oct.*, 1944).—The practical aspects of Southwell's relaxation method of solution are discussed in detail in several typical examples. In one of these the transient flow of heat is considered in a two-dimensional homogeneous isotropic solid. In another the 2 lowest frequencies and the natural modes of vibration of a quadrangular membrane are determined. The biharmonic equation is solved numerically in the case of a plate with clamped deflected edges.

An axially symmetric electric potential distribution problem is solved. Equations of the type

$$\partial(\mu\phi_x)/\partial x + \partial(\mu\phi_y)/\partial y = g(x, y, \phi, \phi_x, \phi_y)$$

where $\mu = \mu(x, y, \phi, \phi_x, \phi_y)$ may be solved by the relaxation method. Examples are given relating to electric potential distribution, soap films, thermal equilibrium of a nest of cylinders in a hot gas stream. L. S. G.

517.947.42 10

Solution by relaxation methods of plane potential problems with mixed boundary conditions. Fox, L. *Quart. Appl. Math.*, **2**, 251–7 (*Oct.*, 1944).—The paper is concerned with the mathematical treatment of Laplace's problem of the second kind, in which the normal gradient of the function is given on the boundary [Abstr. 323 (1944)]. Finite-difference equations are obtained for use in the relaxation method. The technique presented is very suitable for problems in which the boundary conditions involve both the value of the function and its normal gradient. Two examples are given and the results compare favourably with the known exact solution in each case. One of these is the problem of finding a function w, harmonic in the circle $C \equiv x^2 + y^2 - 2x - 2y + 1 = 0$ and satisfying the boundary condition $\partial w/\partial \nu = (y - x)/(x^2 + y^2)$. In the other problem w satisfies the mixed condition

$$(\partial/\partial \nu - r^{-1})w = r^{-2}\{y - x - r\tan^{-1}(y/x)\}$$

where $r^2 = x^2 + y^2$. L. S. G.

518.3 : 532.133 : 535.324.1 *see Abstr.* 60

518.3 : 615.84 11

Some applications of nomography to radiotherapy. Osborn, S. B. *Brit. J. Radiol.*, **18**, 327–31 (*Oct.*, 1945).—Several nomograms applied to X-ray therapy are illustrated (their accuracy varying from 3 to 2%, according to their size) for the calculation of treatment times, under given conditions, for any surface dose, with compensation for changes in the X-ray tube output. B. J. L.

518.3 : 615.84 *see Abstr.* 332

518.5 : 615.84 *see Abstr.* 333

519.2 12

Lognormal distributions. Gaddum, J. H. *Nature, Lond.*, **156**, 463–6 (*Oct.* 20, 1945).—The distribution of x is said to be lognormal when that of $\log x$ is normal, and many examples of such distributions are given. Examples of the more general transformation $X = \log(x + x_0)$ are also given. The conclusion is reached that if scientific observations which show uncontrolled variations large compared with themselves are converted to logarithms before estimating their mean or variance, the usual result is an increase in the accuracy and scope of the conclusions drawn from them. L. S. G.

ASTRONOMY . GEODESY 52

521.03 : 621.396.9 = 5 13

Possibility of astronomic radar with metric waves. Lombardini, P. *Comment. Pont. Acad. Sci.*, **8** (No. 2), 13–9 (1944).

523.12 : 551.12 14

On the astronomical dating of the earth's crust. Shapley, H. *Amer. J. Sci.*, **243 A**, 508–22 (1945). *Daly Vol.*

523.746 : 550.384 *see Abstr.* 290

PHYSICS 53

53.081.5 : 621.385.1.029.6 15

Study of ultra-high-frequency tubes by dimensional analysis. Lehmann, G. J., and Vallarino, A. R. *Proc. Inst. Radio Engrs, N.Y.*, **33**, 663–6 (*Oct.*, 1945).—[Abstr. 2610 B (1945)].

FUNDAMENTALS 530.1

530.12 : 539.152.1 *see Abstr.* 121

530.145 : 517.9 16

On the factorization method for quantum mechanical eigenvalue problems. Lee, H. C. *Chinese J. Phys.*, **5**, 89–104 (*Dec.*, 1944).—The type of problem considered reduces to a determination of the eigenvalues and eigensolutions of the Sturm–Liouville equation $d^2y/dx^2 + \{\lambda + f(x, m)\}y = 0$, where $f(x, m)$ is a function of x and a constant m which may take any one of a set of consecutive integral values. The Schrödinger–Infeld factorization method [Abstr. 1445 (1941)] depends upon the possibility of splitting the above equation in 2 ways, thus:

$$G_mF_my = \{\lambda - k(m)\}y;$$
$$F_{m+1}G_{m+1}y = \{\lambda - k(m+1)\}y,$$

where

$$F_m = g(x, m) + d/dx \text{ and } G_m = g(x, m) - d/dx.$$

The condition for this splitting is given and this, together with two additional conditions, must be satisfied in order that the factorization method be applicable. In this case formulae are given for the eigenvalues and the eigenfunctions. Two examples are given when x is of bounded variation. These relate to spherical harmonics and the Kepler problem in a spherical space. Two more examples are given when the range of variation of x is infinite. These relate to the Kepler problem in ordinary space and to the harmonic oscillator. L. S. G.

530.162 : 621.396.621 = 3 17

Fluctuation effects as limits for amplification and reception. Kleen, W. *Elektrotech. Z.* [*ETZ*], **64**, 473–8 (*Sept.* 9, 1943).—[Abstr. 2664 B (1945)].

MECHANICS OF SOLIDS 531

531.19 : 541.64 *see Abstr.* 230

531.258 18

Lateral bending of symmetrically loaded conical discs. Bisshopp, K. E. *Quart. Appl. Math.*, **2**, 205–17 (*Oct.*, 1944).—The bending problem is studied by noting the analogy between it and the rotating conical

disc problem. Previous methods for solving the latter, in terms of hypergeometric functions [Abstr. 1536 (1944)], are now used to calculate the deflection and stress coefficients. These are arranged conveniently for numerical calculation. An example is given. This consists of a use of the coefficients to estimate stress distributions in a steel valve head of constant weight and various proportions. L. S. G.

531.258 19

On the bending of a clamped plate. WEINSTEIN, A., AND ROCK, D. H. *Quart. Appl. Math.*, **2**, 262–6 (*Oct.*, 1944).—A variational method is applied to the boundary value problem (A) of the bending of a clamped plate of arbitrary shape. It is shown that A may be linked to a simpler equilibrium problem (B) of a membrane by a chain of intermediate problems which may be solved explicitly and in finite form in terms of B. The method yields numerical results for all plates such that B admits an explicit solution. An example considered is that of a clamped square plate under a uniform load. L. S. G.

531.258 20

Effect of a small hole on the stresses in a uniformly loaded plate. MORKOVIN, V. *Quart. Appl. Math.*, **2**, 350–2 (*Jan.*, 1945).—A general method, due to Mushelisvili, for solving plane problems of elasticity is applied to a stress problem recently considered by Greenspan [Abstr. 2002 (1945)]. The results are obtained more quickly and with considerably less labour. L. S. G.

531.314.2 : 537.533.1 : 538.123 *see Abstr.* 109

531.39 : 629.135 21

An analytical theory of landing-shock effects on an airplane considered as an elastic body. KELLER, E. G. *J. Appl. Mech.*, **11**, *A*219–28 (*Dec.*, 1944).—The accelerations at any point of an aircraft during landing are determined. The method is applicable to any type of plane with either tricycle or conventional landing gear. The solution will tend to reduce landing-strength specifications to a more rational basis. G. E. A.

531.391 22

Kron's method of subspaces. HOFFMANN, B. *Quart. Appl. Math.*, **2**, 218–31 (*Oct.*, 1944).—The method is introduced, in terms of a simple dynamical example, in a purely matrix form and then the tensor theory is discussed. The method may be applied to electrical networks and other electrodynamical problems in which the interconnection transformation is non-linear. Some dynamical examples are given. One relates to a system of two rods hinged together without friction, one rod being suspended from its free end. Kron's method is used to set up the equations of motion. L. S. G.

531.55 : 662.1 = 3 23

The V2 rocket. ROTH, F. *Schweiz. Bauztg*, **125**, 75–8 (*Feb.* 17, 1945).—[Abstr. 2735 B (1945)].

531.55/.57 : 778.3 : 621.386.1 24

High speed X-rays. SLACK, C. M., ZAVALES, C. T., AND THILO, E. R. *Steel*, **117**, 120–2 (*Sept.* 10, 1945).—[Abstr. 2619 B (1945)].

MECHANICAL MEASUREMENTS 531.7

531.7 : 541.182 *see Abstr.* 207

531.714.7 : 621.396.619.018.41 25

The use of frequency modulation in a sensitive micrometer. FOLEY, G. M. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 101 (*Aug.* 1 *and* 15, 1945).—To measure the unimpeded displacement of an object, one plate of a small air capacitor is attached to the object. The other plate is fixed close to the moving plate, and the capacitor is used to tune a r.f. oscillator. The change in frequency resulting from motion of the object is converted into proportional d.c. voltage by a receiver similar to a radio receiver. Voltages of ± 300 V are obtained from small displacements, and a magnification of the motion 10^4–10^5 times can be obtained, permitting detection of displacements of $<10^{-6}$ in. The apparatus is robust and stable, and requires no electrical connection with the object. Two such micrometers were placed at rt. angles to measure the rotation of a precision lathe spindle in its bearings, the outputs of the two micrometers being applied to two axes of a c.r.o. A similar micrometer was used as a high-speed recording dilatometer to follow the allotropic transformation of steel on heating and cooling.

531.717.1 : 621.317.39 26

A new coating thickness gauge. LIPSON, S. *Bull. Amer. Soc. Test. Mater.*, **135**, 20–3 (*Aug.*, 1945).—An a.c. energized solenoid with a movable iron core is held in a vertical position over a coated steel article and lowered till the end of the core touches the surface. The distance through which the solenoid must be raised for its pull to overcome the attraction of the core for the ferromagnetic base metal is inversely proportional to the thickness of the coating. M.-V.

531.717.1 : 621.389 : 621.317.39 27

Instrument for measuring thickness of non-conducting films applied over non-magnetic metals. ALEXANDER, A. L., KING, P., AND DINGER, J. E. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 389–93 (*June*, 1945).—[Abstr. 124 B (1946)].

531.724 : 535.43.07 28

A rapid optical method for estimating the specific surface of powders. SHARRATT, E., VAN SOMEREN, E. H. S., AND ROLLASON, E. C. *J. Soc. Chem. Ind.*, **64**, 73–5 (*March*, 1945).—A method of estimating surface areas from an observation of the optical density of their dilute suspensions is examined. This is a very rapid method adapted to routine testing, and does not involve a knowledge of the sp.gr. of the powder under test. The method gives satisfactory results directly with opaque powders lying within the 2·5–150 μ range principally. Transparent powders give low results, but the method is of some value as a means of comparison. The method is also of value as a rapid means of estimating the dispersing power of different deflocculants for a given powder. [See Abstr. 531 (1942), 653 (1943)].

531.752 : 681.26 29

Testing the knife edges of the chemical balance. CRAIG, A. *Rev. Sci. Instrum.*, **16**, 205–9 (*Aug.*, 1945). —A discussion of conditions necessary for accuracy

in weighing, and tests available to chemists. Sharpness and straightness are tested optically and mechanically. Formulae are given for arm ratio, alignment and parallax (the departure of the edges from parallelism with each other), from which gravimetric methods are derived. Tolerances are suggested for use in specifications to control repairs and compare bids.

531.775 : 621.317.39 30

Precision testing of electric tachometers. PRINCI, M. A. *Trans. Amer. Inst. Elect. Engrs*, **64**, 504–8 (*July*, 1945).—The system described permits testing at 22 scale points in a range of speeds from 500 to 4 500 indicated r.p.m. without referring to a standard instrument. The power to drive the tachometers under test is supplied from tachometer generators driven by a d.c. motor controlled by a precision tuning fork. The method of operation and the control system are explained.

531.788.7 31

Ionization gauge of simple construction. FOGEL, C. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 101 (*Aug.* 1 *and* 15, 1945).—A gauge is described for measuring pressures from 10^{-4} to $<10^{-8}$ mm Hg. Except for a multiplying factor of 10, it gives a direct reading of residual air pressure. It uses 2 plates, as the electron and ion collector respectively. They are located on opposite sides of the filament, but equidistant from it. This allows easy outgassing of parts, either by electron bombardment or by r.f. heating. A protective shield in front of the ion collector aids in reducing the electrical leakage to that element. Danger of filament burn-out due to vacuum leaks was removed by using an oxide-coated filament.

MECHANICS OF LIQUIDS 532

532.13 : 536.581.3 *see Abstr.* 83

532.13 : 612.1 : 532.516 *see Abstr.* 33

532.13 : 679.5.04 *see Abstr.* 346

532.133 : 518.3 : 535.324.1 *see Abstr.* 60

532.133 : 541.133 *see Abstr.* 195

532.133 : 541.64 *see Abstr.* 231

532.5 : 626.1 32

Note on flow in canals. JURNEY, W. H. *Quart. Appl. Math.*, **2**, 342–6 (*Jan.*, 1945).—A problem of importance in the design of irrigation systems is considered. A canal joins two pumping stations and water is pumped in at one end and out at the other at constant rates. Starting or stopping the pumps produces long waves in the canal, with associated changes in the height of the water surface. This change in height is calculated, starting from the wave equations. An infinite canal with one source of constant inflow is first considered. Then an image method is used to produce the effect of reflections at the ends of a finite canal. The final expression for the height of the water surface involves the modified Bessel functions and a table of values of the height is given for a range of values of the relative parameters.

L. S. G.

532.516 : 532.13 : 612.1 33

Flow of fluids with non-uniform viscosity in tubes with distensible walls: blood flow. KING, A. L. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 101 (*Aug.* 1 *and* 15, 1945).—3 factors influence the rate of blood flow through a blood vessel: the non-uniformity of plasmal viscosity, the elasticity of the vessel wall, and the presence of erythrocytes and other corpuscles. If the viscosity η of an incompressible fluid depends on speed v and gradient dv/dr in a cylindrical tube, then at any cross-section of radius r the volume flowing per unit time is

$$Q = \pi r^2 \int_0^{v'} v_\eta dv \Big/ \int_0^{v'} \eta dv$$

The speed at the tube wall is assumed to vanish and that at the centre v to be a function of r. The denominator $= -\frac{1}{4}\{d(pr^2)/dx\}$, where r and pressure p are functions of distance x along the tube axis. If the wall material consists of randomly distributed and twisted long chains of molecules, then by rubber analysis methods a relation between p and r may be found and used in the equation for Q. Often the presence of particles, such as erythrocytes in blood, is assumed to affect η; thus the term viscosity becomes less well-defined. In general, the rate of blood flow is not $\propto$ the difference in pressure between the ends of a blood vessel.

532.516 : 621.822 34

Note on the hydrodynamic theory of journal bearings. BELL, J. C. *Amer. Phys. Soc.* (*Proc., June*, 1945) *Abstr. in Phys. Rev.*, **68**, 101–2 (*Aug.* 1 *and* 15, 1945).—A type (*a*) of journal bearing supports a rotating radial load of constant magnitude, but has no rotation of the two surfaces. In order to describe the hydrodynamic lubrication in this bearing, Reynolds' classic equation is generalized to allow for both tangential and normal relative motions of the surfaces. Except for a factor 2, the lubrication in this bearing has the same differential equation as that for either (*b*) a shaft rotating together with a radial load of constant magnitude or (*c*) a rotating shaft with a unidirectional load. Thus, the hydrodynamic lubrication is the same for all these types, except that in type (*a*) a given thickness of film can support 2× the load of the others. Since the service behaviour in types (*b*) and (*c*) is known to depend on film thickness, an alternative explanation is offered for the greater load-carrying capacity of bearings of type (*b*) over type (*c*).

532.517 : 535.55 : 621.133.21 35

Fluid flow study of locomotive firebox design. LEAF, W. *Mech. Engng, N.Y.*, **67**, 586–90 (*Sept.*, 1945).—[Abstr. 38 B (1946)].

532.542 : 628.15 36

Controlling pipe line surges by means of air vessels. BLAIR, J. S. *Proc. Instn Mech. Engrs, Lond.*, **153** (*War Emerg. Issue No.* 1), 1–14 (1945).—[Abstr. 2729 B (1945)].

532.61 37

Time factor in surface tension measurement. ADDISON, C. C. *Nature, Lond.*, **156**, 600–1 (*Nov.* 17, 1945).

532.612 : 669.71.72–175 = 4 *see Abstr.* 343

532.64 38

Advancing and receding contact angles in glass capillaries and the partial removal of contamination by water and soap solutions. ACHARYA, H. K., AND MCBAIN, J. W. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 105 (*Aug.* 1 *and* 15, 1945).—If a capillary (0·025–0·05 cm dia.) freshly drawn from a Pyrex tube is dipped in dist. water, the advancing and receding heights are equal at the same depth, indicating a clean capillary surface with zero-contact angle. If the capillary is contaminated with oleic acid, the advancing height is only about $^1/_3$ as great. Washing of the contaminated capillary with distilled water increases the receding height up to that for a clean tube, while the advancing height remains const. Hence water leaves a residual film of oleic acid on glass even though the receding contact angle becomes zero. Washing with 0·03% Na oleate solution has almost the same effect as washing with dist. water. The still partially contaminated glass is perfectly wetted by the soap solution, advancing and receding contact angles both being zero. Repeated washing with higher concs. of Na oleate solution removes the residual oleic acid and equalizes the advancing and receding heights with those for the clean capillary.

532.69 : 541.183.3 39

Some observations made upon the surface properties of solutions of detergents in water. ROBINSON, J. V. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 107 (*Aug.* 1 *and* 15, 1945).—Peculiarities in the surface behaviour of high mol. wt. substances in aqueous solutions were observed. Surface tension-conc. curves from measurements upon detergent solutions show minima or broad horizontal sections. The absolute surface adsorption of one of these solutions was measured, and found to disagree with that predicted from the adsorption theorem. The surface tension of certain detergent solutions, at the conc. where a min. occurs, may be further lowered by the addition of another surface-active agent. The addition of large amounts of surface-inactive materials to the detergent solutions is shown to produce little surface tension changes in contrast to the large changes shown on adding small amounts of active material. Bubbles rising through solutions of detergents in long tubes accumulate large concs. of the detergent at their surfaces which may be equivalent to hundreds of mol. layers.

532.694.1 40

Foam volumes and foam stabilities. ROSS, S. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 107 (*Aug.* 1 *and* 15, 1945).—Data show the relation between foam stability and foaming volume. The conditions are examined under which foaminess may be accounted an intrinsic property of the liquid. A method of measuring foam volume is described. Data on foaming volumes and foam stabilities are given for a series of hydrocarbons and for a range of conc. of aqueous ethylene glycol solutions. It is shown that the amount of foam formed depends on the method of production and on its stability. The stability of the foam is primarily a function of the liquid.

532.71 : 539.217 : 541.8 *see Abstr.* 237

532.739.2 : 541.64 : 541.24 *see Abstr.* 222

532.74 : 536.7 : 541.122.3 41

Thermodynamics of linearly associated systems. TOBOLSKY, A. V., AND BLATZ, P. J. *J. Chem. Phys.*, **13**, 379–80 (*Sept.*, 1945).—A mathematical study of the applicability of lattice model methods to general thermodynamic problems of reversible association, e.g. associated liquids, such as the alcohols, and solutions of associated materials in non-associating liquids, such as ethyl alcohol–toluene. Equations are found for the equilibrium distribution, free energy and partial molar free energies of solute and solvent with respect to the standard states of pure solvent and pure solute, respectively. N. M. B.

MECHANICS OF GASES 533

533.15 42

The dynamics of a diffusing gas. PUTMAN, H. *Quart. Appl. Math.*, **2**, 267–70 (*Oct.*, 1944).—The equation for the diffusion of two gases is set up and various additional equations are deduced from this. The propagation of discontinuities in the boundary conditions is examined in the simple case of one dimension without gravity. A numerical example is given. L. S. G.

533.275 : 621.317.39 43

An electrical moisture meter. HARTSHORN, L., AND WILSON, W. *J. Instn Elect. Engrs, Pt II*, **92**, 403–15 (*Oct.*, 1945).—[Abstr. 2535 B (1945)].

533.6.011 44

Power series expansions of the velocity potential in compressible flow. BATCHELOR, G. K. *Quart. Appl. Math.*, **2**, 318–28 (*Jan.*, 1945).—The equation for the velocity potential, ϕ, is written in polar co-ordinates (r, θ), and it is solved by expanding ϕ as a power series in r^{-1}. The equation for each coefficient is then linear. In fact, in the case of zero circulation, if we write

$$\phi = r\cos\theta + r^{-1}f_1(\theta) + r^{-2}f_2(\theta) + \ldots .$$

the equation for $f_n(\theta)$, when written in normalized form, leads to Hill's equation. The periodicity of the f_n is considered. The case of finite circulation is next studied and the solutions for f_0 and f_1 are obtained. L. S. G.

533.691 45

Note on the elliptic wing. STEINHARDT, F. *Quart. Appl. Math.*, **2**, 346–7 (*Jan.*, 1945).—In a recent paper [*Zeits. angew. Math. u. Mech.*, **20**, 65–88 (1940)], Krienes used Prandtl's acceleration potential method in the study of the aerodynamics of a lifting surface with an elliptic plan view. The convergence of certain series, appearing in this work, is examined. A numerical example indicates that the convergence is rapid. L. S. G.

533.691.11 46

Rigorous solutions for the spanwise lift distribution of a certain class of airfoils. LAPORTE, O. *Quart. Appl. Math.*, **2**, 232–50 (*Oct.*, 1944).—A family of planforms is found which allows Prandtl's integro-differential equation for the circulation to be solved

rigorously. A conformal mapping, sending the interior of the unit circle into a rectangle, is used in the process. The resulting formulae lend themselves readily to numerical computation. Various special cases, e.g. blunt wing, elliptic wing are studied and rapidly convergent expressions are found for the total lift and total induced drag. Some numerical results are given. L. S. G.

ACOUSTICS . VIBRATIONS 534

534.014.2 : 621.396.61 47

Forced oscillations in oscillator circuits, and the synchronization of oscillators. TUCKER, D. G. *J. Instn Elect. Engrs, Pt III,* **92,** 226–34 (*Sept.*, 1945).—[Abstr. 2646 B (1945)].

534.13 : 678 48

Vibration insulation and structural rubber. CONNON, J. A. *Trans. Amer. Inst. Elect. Engrs,* **64,** 324–9 (*June*, 1945).—Vibration insulating problems are divided into 2 types: those involving the insulation from its surroundings of a unit generating vibrations, and those involving the protection of a delicate unit from external vibrations. The fundamental principles of mechanical vibrations are described, and definitions given of such terms as transmissibility (ratio of transmitted force to impressed force). The variation of transmissibility with frequency ratio is described, and the effect of damping is demonstrated. The design of various forms of rubber mounting is described, and it is pointed out that in any rubber suspension system a damping force originates in the mountings and acts on the mass to prevent building up of large forces and amplitudes at or near resonance and to decrease the efficiency of mountings at frequency ratios greater than $\sqrt{2}$. The amount of damping must be a compromise between good low-frequency effects and poor high-frequency effects, thus it is desirable ordinarily to have the min. damping that will satisfactorily limit resonant vibration. The mechanical properties of rubber are described with reference to its use as a mounting material. A. C. W.

534.15 : 629.135 : 620.178.311.5 49

Aircraft-engine-accessory vibration. TYLER, J. *Trans. Amer. Inst. Elect. Engrs,* **63,** 1334–49 (*Suppl. Dec.*, 1944).—[Abstr. 2367 B (1945)].

534.321.9 : 534.614 50

Temperature effect on ultrasonic velocity in water. SINGH, B. K. *Nature, Lond.*, **156,** 569 (*Nov.* 10, 1945).—The velocity of 5·7 Mc/s waves in water, measured by an optical diffraction method, increased from 1 510 m/sec at 31·5°c to 1 557 m/sec at 70·3°c.

534.372 : 621–752.2 51

Some practical applications of rubber dampers for the suppression of torsional vibrations in engine systems. ZDANOWICH, R. W., AND MOYAL, J. E. *Proc. Instn Mech. Engrs, Lond.*, **153** (*War Emerg. Issue No.* 3), 61–82 (1945).—[Abstr. 37 B (1946)].

534.614 : 534.321.9 *see Abstr.* 50

OPTICS . RADIATION . SPECTRA 535

535.13 : 538.12 *see Abstr.* 108

535.214 52

Ponderomotive forces of light upon matter as shown by experiments. EHRENHAFT, F. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68,** 102 (*Aug.* 1 *and* 15, 1945).—In a vertical beam of light, particles of Cr, Fe, Ni, Mn, CuO, of about the order of the wavelength of light, fall vertically, while some of those slightly larger describe, in falling, helical paths in the beam of light. The radius of the helical path is large compared with the radius of the body. The path has been observed with linear polarized and natural light and with and without parallel external magnetic fields.

535.215.5 : 541.183 53

Lowering of the photo-electric work function of zirconium, titanium, thorium and similar metals by dissolved gases. RENTSCHLER, H. C., AND HENRY, D. E. *Trans. Electrochem. Soc.*, **87** (*Prepr.* 14), 10 *pp.* (1945).—Describes experiments which show a photoelectric threshold shift towards the longer wavelength due to the interaction of O_2, N_2 or H_2 with Zr, Ti, etc. The results indicate that the lowering of the photoelectric work function is caused by the formation of a solid solution of the gas in the metal.

535.245 : 628.97 54

Brightness limitations for luminaires. CROUCH, C. L. *Illum. Engng, N.Y.*, **40,** 427–49 (*July*, 1945).—[Abstr. 2731 B (1945)].

535.247.4 : 535.651.2 = 3 55

Universal instrument for spectral and integral light and colour measurement. MÄDER, F. *Helv. Phys. Acta.*, **18** (*No.* 2), 125–57 (1945).—Gives full details of an instrument based on the Ives principle of applying a shaped diaphragm to a dispersed beam of light, so that the response of a photocell to the recombined beam agrees with that of the standard eye. The instrument can be used for determining spectral transmission or reflection curves, spectral energy distribution curves, comparison of light intensities in terms of visual response, as well as for the determination of colour co-ordinates of both light sources and coloured reflecting surfaces. J. W. T. W.

535.247.4 : 551.593.5 *see Abstr.* 318

535.31 : 778.15 56

Simple theory of the rectification of photographs taken with an inclined plate. BLOCH, A. *Photogr. J. A*, **85,** 32–7 (*March–April*, 1945).—Discusses various points arising from an earlier paper [see Abstr. 1623 (1943)]. The effects on the projected image of various adjustments in enlarging are discussed and the procedure for obtaining corrected photographs is described. A. H.

535.31 : 778.15 57

Rectification of tilted photographs. DICKSON, J. H. *Photogr. J. A*, **85,** 38–42 (*March–April*, 1945).—Discusses the rectification of the distorted view obtained when a camera is used with its negative plane tilted at an angle to the plane of the object photographed. Rectification is obtained by placing the negative at a calculated angle to the printing paper, tilting the lens and moving the plate bodily in its own plane through a calculated distance. Formulae for

the practical solution of the problem are obtained and discussed. A. H.

535.317.6 58

Studies in optics. I. General co-ordinates for optical systems with central or axial symmetry. II. Analysis of a given system with the help of the characteristic function, using the direct method of analysis. HERZBERGER, M. *Quart. Appl. Math.*, **2**, 196–204 (*Oct.*, 1944) *and* 336–41 (*Jan.*, 1945).—Formulae developed in previous papers [Abstr. 1999, 2000 (1944)] are generalized and the most general treatment of systems with central or axial symmetry is given. Ray tracing formulae (using a vector notation) are found and the Lagrangian invariant is derived. Application is made to the symmetrical systems mentioned and the forms assumed by the fundamental formulae for special choices of the co-ordinates are found, e.g. Hamilton's point characteristic, the angle characteristic, the direct method. In the second part, the direct theory is linked with Hamilton's characteristic function, and the method is used to find the image of an arbitrary surface in a given axially symmetric system. As an example the image formation of a sphere is studied. L. S. G.

535.32 : 541.18 *see Abstr.* 204

535.322.4 59

A direct reading refractometer. HOLMES, J. G. *J. Sci. Instrum.*, **22**, 219–21 (*Nov.*, 1945).

535.324.1 : 532.133 : 518.3 60

Molecular refraction—viscosity constant nomograph. LAGEMANN, R. T. *Industr. Engng Chem.*, **37**, 600 (*June*, 1945).

535.33 : 771.5 *see Abstr.* 354

535.33 : 771.534.531 61

The quantitative evaluation of photographic line patterns. BRENTANO, J. C. M. *J. Opt. Soc. Amer.*, **35**, 382–9 (*June*, 1945).—Difficulties encountered in the quantitative evaluation are discussed, particularly in such cases where integrated intensities are required. As a result 2 methods, applicable to absorption densitometry, are proposed. One method consists in recording with the densitometer tracing of the line pattern a tracing of a stepped wedge which serves to establish correlation between the densitometer record and a standard conversion curve by projecting the steps in superposition with the corresponding points of the curve. The other consists in recording the line pattern on a moving plate or film which has the result of reducing the peak densities and improving the line shape with but a small increase of line width and exposure time. The first method is equally applicable to the visible and X-ray range, the second method is primarily intended for X-ray patterns.

535.331 : 545.828 *see Abstr.* 261

535.333 62

Spectra of diatomic oxides by the method of exploded wire. ROSEN, B. *Nature, Lond.*, **156**, 570 (*Nov.* 10, 1945).

535.336.2 : 537.533.7 63

The electron optics of mass spectrographs and velocity focusing devices. HUTTER, R. G. E. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 98 (*Aug.* 1 *and* 15, 1945).—The results of the theory of mass spectrometers and velocity focusing devices are derived again by a simpler method. It brings out more clearly the electron-optical nature of the deflecting and focusing properties of the fields employed in the instruments.

535.336.2 : 539.155.2 = 3 *see Abstr.* 124

535.337 : 537.228.5 *see Abstr.* 86

535.338.3 : 537.533.8/.9 : 539.153 *see Abstr.* 123

535.338.4–15 64

The infra-red spectra of chloroform and bromoform. JENKINS, G. L., AND STRALEY, J. W. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 99 (*Aug.* 1 *and* 15, 1945).—The spectra were observed in both the liquid and vapour states in the region from 2–15 μ, A number of overtone and combination bands were observed. The contour of several fundamental bands permitted an approx. calculation of the m. of i. and other mol. magnitudes. The frequencies in cm^{-1} of the fundamental bands examined are:

	$CHCl_3$		$CHBr_3$	
	Liquid	Vapour	Liquid	Vapour
$\delta 2$	762·2	771·0	—	—
$\delta 5$	3 018·4	3 034·4	3 012·0	3 049·2
$\delta 6$	1 216·5	1 218·9	1 142·4	1 147·7

535.338.4–31 65

Near ultra-violet emission bands of benzene. INGOLD, C. K. *Nature, Lond.*, **156**, 569 (*Nov.* 10, 1945).—[See Abstr. 2903 (1945)].

535.338.42 66

Some new measurements on ω_3 of $C^{12}O_2^{16}$ and $C^{13}O_2^{16}$. NIELSEN, A. H., AND YAO, Y. T. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 99 (*Aug.* 1 *and* 15, 1945).—The vibration designated ω_3 for the molecules $C^{12}O_2^{16}$ and $C^{13}O_2^{16}$ with band centres at 2 350 cm^{-1} and 2 284 cm^{-1} were completely remapped with a prism-grating spectrometer using a 7 200 line/in Wood replica grating. In all portions of the bands where no overlapping occurs, the resolution of the rotation lines is complete. In the region where the P branch of the $C^{12}O_2^{16}$ overlaps with the R branch of the $C^{13}O_2^{16}$ though not complete, the resolution is sufficiently good to permit the identification of the lines of both bands. The grating was calibrated with a Hg arc, and it is believed that the rotation lines are now known to $\pm 0{\cdot}07$ cm^{-1}. In mapping these bands galvanometer deflections were read at intervals of $0{\cdot}07$ cm^{-1} and plotted v frequencies in cm^{-1}. The slits were set to include a frequency interval of $0{\cdot}3$ cm^{-1}.

535.338.42–15 67

Further measurements on ω_1 and ω_2 of CD_3Cl in the infra-red. NIELSEN, H. H., AND NIELSEN, A. H. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 99 (*Aug.* 1 *and* 15, 1945).—ω_1 and ω_2 were completely remapped in the first order of a 7 200 line/in Wood replica grating. The parallel vibration ω_1 was so well resolved, that a knowledge of the rotational spacing is now available. This spacing, averaged over the whole band, is about $0{\cdot}7$ cm^{-1}

instead of 1·01 cm^{-1} as previously reported. The value 0·7 cm^{-1} is in agreement with the Δv observed for the other parallel bands ω_3 and ω_5. The m. of i. I_A calculated from this spacing is $80{\cdot}1 \times 10^{-40}$ g cm^2. Complete resolution of the Q branches in the perpendicular vibration ω_2 is also effected. It is believed that the positions of the rotation lines in both bands is known to $\pm 0{\cdot}07$ cm^{-1}.

535.343 68

Absorption bands in the spectrum of butadiene. YAO, Y. T. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 99 (*Aug.* 1 *and* 15, 1945).—The absorption region near 3·2 μ was examined using an echellette grating at intervals corresponding to 0·29 cm^{-1}. The slits subtend an interval of approx. 0·4 cm^{-1}. It was revealed that this region consists of at least two bands, one with its centre at 3·21 μ and the other with its centre at 3·3 μ. Some indication of rotational structure was found. The bands at 9·86 μ and 11·01 μ were observed with a grating ruled with 800 lines/in at intervals corresponding to 0·29 cm^{-1} and 0·214 cm^{-1}, respectively. A rotational separation of about 1·9 cm^{-1} was observed. This structure was better defined in the 11·01 μ than in the 9·86 μ band.

535.343.32 : 541.67 *see Abstr.* 232

535.343.32 : 545.823 *see Abstr.* 260

535.35 69

Effect of excitation frequency on spectrum of gaseous discharges. HAYES, K. J., WINANS, J. G., AND CULP, W. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 98 (*Aug.* 1 *and* 15, 1945).—It was observed that commercial Ne bulbs show a purple tinge when excited at frequencies >10 Mc/s. Spectroscopic studies of this effect were made with frequencies 0·29, 0·34, 0·75, 1·5, 8, 16, 32, 64, 130, 390 and 600 Mc/s as well as 60 c/s and d.c. The purple glow appears at about 10 Mc/s and increases in intensity up to 600 Mc/s. The purple colour is due to the excitation of the violet lines of A which is present in small quantity. The change occurred at the electrode as well as in the gas. A tube containing pure Ne gave no noticeable change in spectrum with change in excitation frequency. A similar effect was observed with commercial A filled bulbs. The spectrum at 60 c/s consisted almost entirely of the violet second positive bands of N. At frequencies >10 Mc/s the orange first positive bands of N were obtained with high intensity, and the colour of the discharge was orange instead of violet. Tubes containing pure N did not show this effect. These results show that in gas mixtures producing these effects, the spectra requiring the smaller excitation energy gain in intensity with increase in excitation frequency.

535.371 70

Factors affecting phosphorescence decay of the zinc sulphide phosphors. FONDA, G. R. *Trans. Electrochem. Soc.*, **87** (*Prepr.* 7), 14 *pp.* (1945).—Modifications of the energy-band theory of the solid insulator were found useful in explaining the mechanism underlying several different aspects of phosphorescence. These include (1) the relation between afterglow and phosphorescence, the effects (2) of partial alterations in composition and (3) of changes in structure, (4) the action of a secondary activator, and (5) the differences in decay after cathode ray excitation and after ultraviolet. More serious consideration should perhaps be given to other possible modifications of the energy diagram.

535.375.5 71

Raman spectrum of $Ni(NO_3)_2 6NH_3$ crystal; effect of crystal field on the nitrate ion. WU, T. Y. *Chinese J. Phys.*, **5**, 180–6 (*Dec.*, 1944).—The spectrum was taken with the view of studying the effect of the crystal field on the inner vibrations of the NO_3 group of which a particular behaviour is suggested by X-ray analysis. A line was found at about 985 cm^{-1}. This result and the splitting of the line at about 1 050 cm^{-1} into a doublet in $Cu(NO_3)_2 3H_2O$ and $Cu(NO_3)_3 6H_2O$ crystals are discussed from the viewpoint of the two-minimum problem similar to the NH_3 molecule. L. S. G.

535.375.51 72

Raman spectra of spiropentane and 1,1-dimethylcyclopropane. CLEVELAND, F. F., AND MURRAY, M. J. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 98–9 (*Aug.* 1 *and* 15, 1945).—The depolarization factors of the Raman lines of spiropentane were obtained by use of the method previously described. Raman frequencies, estimated relative intensities, and qualitative depolarization factors were obtained for 1,1-dimethylcyclopropane. The spectra of the two compounds, each of which has at least one 3-membered ring, are compared and discussed in the light of the group theory selection rules.

535.375.54 73

The Raman effect in rocksalt. BORN, M., AND BRADBURN, M. *Nature, Lond.*, **156**, 567–8 (*Nov.* 10, 1945).—The spectrum calculated from the orthodox theory of lattice dynamics provides a satisfactory explanation of Rosetti's [*ibid.*, **127**, 626 (1931)] and Krishnan's [Abstr. 1886 (1944)] observations.

535.42 : 537.531 : 539.266 *see Abstr.* 162

535.42 : 539.26 *see Abstr.* 160

535.42 : 548.73 *see Abstr.* 281

535.43 : 537.531 : 548.73 *see Abstr.* 282

535.43 = 3 74

On the demonstration of interference phenomena by scatter particles in the interference region. MOLLWO, E. *Z. Phys.*, **120** (*Nos.* 7–10), 618–26 (1943).—Sharp interference fringes are produced in a thin, wedge-shaped, evaporated, transparent crystal layer by means of several multi-reflected light rays. They are rendered visible by very small scatter particles beneath the reflecting layer surface. H. G. S.

535.43.07 : 531.724 *see Abstr.* 28

535.55 : 621.133.21 : 532.517 *see Abstr.* 35

535.651 = 3 75

Colorimetry with a vacuum photocell and composite filters. KÖNIG, H. *Helv. Phys. Acta.*, **17** (*No.* 7), 571–9 (1944).—Describes a "standard observer" for colorimetry, using a K-photocell and ten composite glass filters. The particulars of the filters and their

components are specified and an example is given showing the application of the method to a determination of the colour coefficients of ten coloured filters. The results agree well with those obtained by calculation from the spectral transmission curves. J. W. T. W.

535.651.2 : 535.247.4 = 3 *see Abstr.* 55

HEAT . THERMODYNAMICS 536

536.21 : 517.63 76

Note on the problem of heat conduction in a semi-infinite hollow cylinder. LOWAN, A. N. *Quart. Appl. Math.*, **2**, 348–50 (*Jan.*, 1945).—It is shown that the problem of Tranter [Abstr. 1333 (1944)] and generalizations of it may be solved by a method [Abstr. 4588 (1937)] employing one Laplace transform only.

L. S. G.

536.21 : 550.362 *see Abstr.* 288

536.212.3 : 621.3.012.8 : 662.998 : 662.95 77

Insulation of heat treatment furnaces. SARJANT, R. J. *Inst. Fuel War Time Bull.*, 189–202 *and* 219 (*June*, 1945).—[See Abstr. 201 B (1946)].

536.423.15 : 614.71 78

A device for automatically controlling the concentration of glycol vapors in the air. PUCK, T. T., WISE, H., AND ROBERTSON, O. H. *J. Exp. Med.*, **80**, 377–81 (*Nov.*, 1944).—A light beam is focused on to the polished Cr-plated rim of a slowly rotating Cu disc and reflected into a photocell. The disc is 3 in. dia., ¼ in. thick and the lower third of the disc dips into a constant-level water bath, and a cloth wick is sewed against the other side of the disc. The wheel is cooled by rapid evapn. of water from the wick caused by an air current from a small fan. Condensation of glycol vapour on the cooled rim of the wheel forms a film which interferes with the reflection to the photocell, which controls the output of the glycol vaporizer. The instrument can be used to measure very rapidly the glycol content of room air and should greatly facilitate tests of the efficacy of glycol vapours in preventing air-borne infections. C. J. G.

536.461 79

The stability of burner flames. GARSIDE, J. E., FORSYTH, J. S., AND TOWNEND, D. T. A. *J. Inst. Fuel*, **18**, 175–86 (*Aug.*, 1945).—Account of work carried out to elucidate the factors affecting flame stability, the fields dealt with being the measurement of flame speeds, and an examination of the mechanism of light-back and of blow-off. R. W. P.

536.51 80

Response time and lag of a thermometer element mounted in a protecting case. GOODWIN, W. N., JR. *Trans. Amer. Inst. Elect. Engrs*, **64**, 665–70 (*Sept.*, 1945).—Equations are derived and applied for determining the response time and temperature lag, in general, of a body which exchanges heat with a medium indirectly through a second body. Application is made to a resistance-type thermometer, mounted in a protecting case, as is used for aircraft and marine purposes. The temperature distribution along the stem and the errors resulting when the head of the bulb and medium differ in temperature are derived.

536.532 : 611.77.087.86 81

Silver plated constantan thermopiles for skin temperature measurements. GULLBERG, J. E., TOBIAS, C. A., AND WELTON, H. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 105–6 (*Aug.* 1 *and* 15, 1945).—If 200 turns/in of 1·5 mil constantan wire are wrapped around a polystyrene form and the wires plated with 50 mg/cm of Ag by partly submerging the form in a plating solution, 400 junctions of small mass and heat capacity are obtained. Half the junctions are placed in contact with a Cu block insulated by a very thin piece of mica; the other half are placed in contact with the surface whose temperature is to be determined. The potential from 200 turns/in is 6·5 mV/°C. Methods of calibration, linearity and sensitivity are discussed. A radiometer of similar design has been constructed.

536.581 : 621.314.212 82

Thermostat control for triple-rated transformer. MORGAN, H. A. *Pwr Plant* (*Engng*), **47**, 72–3 (*Nov.*, 1943).—[Abstr. 2464 B (1945)].

536.581.3 : 532.13 83

Thermostatic bath for low temperatures. RUH, E. L., CONKLIN, G. E., AND CURRAN, J. E. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 451–2 (*July*, 1945).—A bath, primarily for low-temp. viscosity determinations, operates at temps. ranging from +40° to −70°F. It is a 3-stage installation, one bath containing dry ice and isopropyl alcohol, a second maintained under rough automatic control, and a third under close control. The last is a vacuum-jacketed glass jar, filled with acetone, and equipped with accessories for mounting viscometers.

536.587 : 621.316.74 84

An anticipatory method for improving automatic temperature control. MANJOINE, M. J. *Instruments*, **18**, 454–5 (*July*, 1945).—A vacuum-tube thermocouple device is described for improving the sensitivity and response of conventional furnace temperature controllers by anticipating temperature changes and initiating corrective steps. It contains two thermocouples of different thermal capacities, and a heating element which is energized from the main contactor relay control lines. The thermocouples are connected in series with the control thermocouple so that the polarity of the couple with less thermal capacity is additive and the polarity of the other couple is subtractive with respect to the furnace thermocouple. The elements are placed in an evacuated tube which is small enough to fit inside standard controllers.

M.-V.

536.655 : 536.751 : 541.25 *see Abstr.* 223

536.7 : 541.122.3 : 532.74 *see Abstr.* 41

536.7 : 541.24 : 541.64 : 541.182.5 *see Abstr.* 210

536.751 : 536.655 : 541.25 *see Abstr.* 223

ELECTRICITY . MAGNETISM . X-RAYS CHARGED PARTICLES 537/538

537.212 85

Potential distributions of equal coaxial cylinders. HILL, R. D. *Rev. Sci. Instrum.*, **22**, 221–2 (*Nov.*, 1945).

537.228.5 : 535.337 = 3 86

On the inverse Stark effect of the D lines of sodium. KOPFERMANN, H., AND PAUL, W. *Z. Phys.*, **120** (*Nos.* 7–10), 545–52 (1943).—The inverse Stark effect and the hyperfine structure of the D lines of Na are investigated with an atomic beam. The D_1-line consists of two π- and two σ- and the D_2 line of two π- and four σ-components. The hyperfine structure of each D line is shifted as a whole to the red, and then double fission occurs within the σ-components of the D_2 line. The shift of the $^2S_{1/2}$ terms in the electric field is calculated, the derived shifts of the ^2P terms agreeing well with the premises of the theory. H. G. S.

537.291 : 538.691 87

The paths of ions and electrons in crossed, non-uniform electric and magnetic fields. COGGLESHALL, N. D. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 98 (*Aug.* 1 *and* 15, 1945).—The integration of the force equations for charged particles moving in certain types of non-uniform magnetic fields was reported earlier. It was found that the force equations for a charged particle moving in the presence of particular types of crossed, non-uniform electric and magnetic fields may be integrated by a generalization of the same method. The cases which permit integration are those such that the electric and magnetic fields are crossed and are both functions of the same co-ordinate, either Cartesian or cylindrical. The integration may be done numerically by a direct method if the field variations are too complicated for analytical evaluation or if the fields are known only experimentally. Using this approach the calculations for some of the known types of crossed field mass spectrographs and β-ray spectrographs are shown to be special cases of the general method. From the functions involved in the quadratures the periodicity of the orbits, their spatial extension and dependence on initial conditions can be deduced.

537.311.33 : 541.22 : 541.183.56 *see Abstr.* 220

537.311.33 = 4 88

Contribution to the study of the electrical conductance of agglomerate substances. ALISSOFF, A. *Rev. Gén. Élect.*, **49**, 69–90 (*Feb.*, 1941).—Describes experimental work on the conductance of carborundum compounds and other semi-conductors which do not obey Ohm's Law. Their properties depend on current density, applied voltage, duration and recovery time. The work also showed that when the current passes for a sufficiently long time the properties become stable, the voltage varying as $I^{0.3}$ and the conductance as $I^{0.6}$. Various hypotheses are formulated and examined but it is concluded that it is not possible to define the properties of this type of conductor very satisfactorily. E. H. W. B.

537.312.62 = 3 89

On current distribution in supraconductors. V. LAUE, M. *Z. Phys.*, **120** (*Nos.* 7–10), 578–87 (1943).—The current branching theorem and Meissner effect, the current distribution in a system partially normally conducting and partially supraconducting, the calculation of such distributions according to the London theory of supraconductors, and a generalization of the distribution theorem are the subjects dealt with. H. G. S.

537.363 : 541.18 = 4 *see Abstr.* 205

537.363 : 621.3.032.216.2 90

Cataphoresis and alundum coatings. BIDGOOD, E. S., AND KENT, G. H. *Trans. Electrochem. Soc.*, **87** (*Prepr.* 4), 9 *pp.* (1945).—[Abstr. 51 B (1946)].

537.52 : 541.127.3 *see Abstr.* 191

537.523.4 = 3 91

Cross-section of the ignition track and ignition with confined irradiation. FUCKS, W., AND BONGARTZ, H. *Z. Phys.*, **120** (*Nos.* 7–10), 468–75 (1943).—The cross-section of the discharge track at the moment of instability is determined in air at atmos. pressure for different spark lengths. The method [Abstr. 2302 B (1939)] is an indirect one based on the measurement of the drop of the ignition potential due to irradiation of the cathode with ultra-violet light. The cross-section of the ignition track increases with the length of the spark-gap, but the ratio of the track diameter to the spark-gap decreases. H. G. S.

537.523.4 = 4 92

Investigation of the spark discharge in air. MAUDUIT, A. *Rev. Gén. Élect.*, **49**, 117–24 (*Feb.*, 1941).—By means of a d.c. source capable of generating up to 200 kV, laboratory discharges are produced between spheres of equal and unequal diameters, pointed rod electrodes, and point-sphere as well as point-plane gaps, with the unsymmetrical electrodes forming both the positive and negative discharge pole respectively. The visual discharge phenomena which precede the final breakdown are described in some detail as a function of the applied voltage. The classical discharge theory is outlined and a qualitative explanation is offered of the various types of discharge observed. A brief description is given of the behaviour of point-plane gaps under impulse conditions, based on photographic evidence. R. H. G.

537.531 : 535.42 : 539.266 *see Abstr.* 162

537.531 : 535.43 : 548.73 *see Abstr.* 282

537.531.7 : 575.243 *see Abstr.* 324

537.531.7 : 576.8.095.14 *see Abstr.* 326

537.533 : 537.59 93

Further work on the artificial production of mesotrons. GROETZINGER, G., AND SMITH, L. *Phys. Rev.*, **68**, 55–6 (*July* 1 *and* 15, 1945).—[See Abstr. 1966 (1945)].

537.533.1 : 531.314.2 : 538.123 *see Abstr.* 109

537.533.1 : 621.385.2 94

Electron transit time in time-varying fields. BRONWELL, A. B. *Proc. Inst. Radio Engrs, N.Y.*, **33**, 712–6 (*Oct.*, 1945).—[Abstr. 2613 B (1945)].

537.533.7 : 535.336.2 *see Abstr.* 63

537.533.72 : 538.691 95

The paths of ions and electrons in non-uniform magnetic fields. COGGESHALL, N. D., AND MUSKAT, M. *Phys. Rev.*, **66**, 187–98 (*Oct.* 1 *and* 15, 1944).—The integration of the Lorentz force equations to give electron or ion paths is reduced to simple quadratures for systems in which the electric field is zero and the magnetic field is a function of one Cartesian or

cylindrical co-ordinate. For several types of magnetic field variation, the quadrature can be carried through analytically; for complicated magnetic fields, numerical integration can be effected. From general considerations of the functions involved, it is possible to determine the extension and periodicity of the orbits for any set of initial conditions. The representation is convenient for obtaining information on the dispersion and focusing characteristics of the trajectories. Schematic designs of mass spectrometers and beta-ray spectrographs are proposed, and a discussion is given of their properties.

537.533.72 : 676 : 621.385.833 96

Electron microscope and its applications. REES, A. L. G. *Proc. Tech. Sect. Paper Mkrs' Ass.*, **25**, 53–64 (*Dec.*, 1944).—[Abstr. 159 B (1946)].

537.533.73 97

Anomalies in the electron diffraction pattern of magnesium oxide. HILLIER, J., AND BAKER, R. F. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 98 (*Aug.* 1 *and* 15, 1945).—MgO smoke and MgO reagent were examined by a transmission electron diffraction camera with a resolving power at least an order of magnitude higher than used previously. Under these conditions a number of the rings became multiple indicating that MgO does not have an accurately cubic structure. The (111) ring appeared as a doublet with $d(111) = 2{\cdot}451$ Å and $2{\cdot}398$ Å. The (200) line appeared single and sharp. The 220 had an unusual contour on the ring patterns but was resolved into 5 rings by studying single crystal reflections. The spacing corresponding to the 5 rings is as follows: $1{\cdot}468$, $1{\cdot}477$, $1{\cdot}485$, $1{\cdot}493$, $1{\cdot}502$. (222), (224), (226) and (333) rings were also observed as doubled.

537.533.73 = 3 98

Symmetrically excited electron interferences. KASSEL, W., ACKERMANN, I., AND MÖLLENSTEDT, G. *Z. Phys.*, **120** (*Nos.* 7–10), 553–60 (1943).—Consideration of the dynamic interplay of electron waves from different directions incident simultaneously on a crystal, and observations on the fine structure of electron diffraction processes, give information regarding the departures from simple Bragg reflection at crystal planes. H. G. S.

537.533.74 99

Scattering of electrons by matter. WINCHESTER, G. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 100 (*Aug.* 1 *and* 15, 1945).—Scattering within an absorber is probably due to the non-uniform force fields within the material. The matter (thickness or g/cm²) necessary to absorb ½ of a certain intensity of β radiation from a radioactive material depends upon the force fields existing between the atoms of the absorber. If the force fields of an absorber (or scatterer) are changed, then the ½ thickness value also changes, regardless of the number of atoms involved. The scattering of β particles of RaE by hard rolled and by annealed Al is different (up to 17%, depending on the method of annealing) and can be shown experimentally. The scattering of β particles by a sheet of Al before and after prolonged gentle tapping is different, the tapped condition causing the largest scattering. This may be due to an increase in the number of crystals/mm². It appears that the coefficient of absorption of β particles by an absorber depends upon its state of aggregation.

537.533.8/.9 : 535.338.3 : 539.153 *see Abstr.* 123

537.534.74 : 539.185 *see Abstr.* 148

537.542 : 539.16.08 : 622 = 3 100

The Geiger–Müller tube-counter in the service of mining. RAJEWSKY, B. *Z. Phys.*, **120** (*Nos.* 7–10), 627–38 (1943).—A detailed account with illustrations of the development of an instrument based on the Geiger–Müller tube-counter for the detection and measurement of Ra and other radioactive ores. H. G. S.

537.542 : 539.165 *see Abstr.* 140

537.561 101

The ionization potentials of butadiene. SUGDEN, T. M., AND WALSH, A. D. *Trans. Faraday Soc.*, **41**, 76–80 (*Feb.*, 1945).—Evidence based upon the vacuum ultra-violet spectrum and electron impact determinations of ionization potentials is presented to show that butadiene exists in two forms, *s-cis* and *s-trans*, at room temperature. The *s-cis* form has a min. ionization potential of $8{\cdot}71$ V as against $9{\cdot}02$ V for the *trans* isomer. This fact makes it possible to explain the low ionization potentials of cyclopentadiene and cyclohexadiene without recourse to the theory of hyperconjugation.

537.59 : 537.533 *see Abstr.* 93

537.591 = 3 102

Observations on the hard component of cosmic radiation. KULENKAMPFF, H. *Z. Phys.*, **120** (*Nos.* 7–10), 561–79 (1943).—The general character of the intensity of the mesotron component of cosmic radiation is discussed taking into account the interdependence of decay and absorption and that they are not simply additive. The intensity is represented by $I = T^{-\gamma}$ (T = layer thickness in g/cm²), and values are given for air with increasing and with decreasing layer thickness, and water with increasing layer thickness. The most reliable value of the mesotron decay constant is stated to be $\tau = (1{\cdot}5 \pm 0{\cdot}7) \times 10^{-6}$ sec. H. G. S.

537.591 = 3 103

Direct determination of the mass of a mesotron by elastic collision. LEPRINCE-RINGUET, L., NAGEOTTE, E., GORODETZKY, G., AND RICHARD-FOY, R. *Z. Phys.*, **120** (*Nos.* 7–10), 588–97 (1943).—The technique employed, based on the observation of the curvature changes and the track of the particle in the magnetic field in passing through matter, is detailed. The value obtained is 240 ± 22 e.m. H. G. S.

537.591.15 104

Decay electrons from neutral mesotrons of small mass. KRUGER, P. G., AND SMITH, L. W. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 104 (*Aug.* 1 *and* 15, 1945).—In an earlier report it was suggested that a new neutral radiation might consist of neutral small mass mesotrons. To test this hypothesis the penetrating radiation was examined with a cloud chamber, surrounded by a ring (19 cm thick)

of Pb blocks (6 in high) in the horizontal plane. Several hundred stereoscopic pictures were taken with the cloud chamber in a magnetic field of about 1 000 oersteds. 3 Al foils 0·8 mm thick were spaced 5 cm apart in the cloud chamber. Observation of the loss of energy suffered by an electron in passing through the foils permits the determination of the direction of electron motion. If a neutral mesotron decays into positive and negative electrons, both having the same energy, tracks showing a decrease in energy in opposite directions along the track should be observed. Several such pictures were obtained. It appears that the decay electrons have energies between 2·5 and 6 eMV and the rest mass of the neutral mesotron varies between 13 and 24 mc^2.

537.591.3 = 3 105

On the anomalous absorption in air and life of the meson. BERNARDINI, G. *Z. Phys.*, **120** (*Nos.* 7–10), 413–36 (1943).—A detailed description and discussion of experiments carried out to determine the ratio of the average life of the meson to the potential energy, from absorption curves of the meson components in air and Pb. The mean value obtained between sea level and 4 000 m is $\tau/\mu c^2 = 3 \times 10^{-8}$ on the assumption that the hard components consist of unstable particles of one type; the particles are not produced to a marked extent below 4 000 m. The decay of the mesons occurs with the release of one neutrino and one electron. H. G. S.

537.591.8 106

Cosmic-ray mesotron ionization in helium and argon gases. SKOBEL'TSYN, L. L. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 103–4 (*Aug.* 1 *and* 15, 1945).—Counter-controlled cloud-chamber photographs of cosmic-ray mesotron track were taken in He and A gases. The chamber was operated as previously described in the case of H. A triple-coincidence counter telescope was used with sufficient Pb above the chamber so that electron tracks could be distinguished from mesotron tracks. The expansion of the chamber was delayed to allow the ions to diffuse sufficiently for drop counting. The clearing field was reduced after sufficient time for the track to be separated into positive and negative ion columns. Studies of condensation efficiencies for a wide range of alcohol-water vapour mixtures indicate that whenever >50% of the negative ions have formed drops, then all the positive ions have formed drops. From photographs of tracks taken under these conditions, the average specific ionization was determined by counting the number of positive ion drops per cm of path.

537.741.55 : 621.314.12 107

A galvanometer amplifying system of great sensitivity. GALL, D. C. *J. Sci. Instrum.*, **22**, 218–9 (*Nov.*, 1945).—A sensitive galvanometer coil with a fairly short period is suspended from another coil above it, so that the zero of the lower coil is controlled by the deflection of the upper coil. Light reflected from the mirror of the lower coil operates a photocell, which controls a thyratron. Current from the thyratron passes through the upper coil, so that the sensitivity of the system is greatly increased by positive mechanical feedback. To stabilize the system, negative electrical feedback is applied in series with the bottom coil. High or low input resistance arrangements are possible, and fractions of a microvolt can be measured.

538.12 : 535.13 = 4 108

The magnetic field of an electromagnetic wave. BRYLINSKI, E. *Rev. Gén. Élect.*, **49**, 313–6 (*May*, 1941).—[See Abstr. 984 B (1940)].

538.123 : 537.533.1 : 531.314.2 109

Accelerational-velocital magnetic forces. WARBURTON, F. W. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 100 (*Aug.* 1 *and* 15, 1945).—Magnetic potential energy as a function of relative position, velocity and acceleration of two electrical charges, when used in the generalized Lagrangian equations of motion and extended to include terms in $1/c^3$, provides expressions for the mutual force of one charge on the other containing the product of the velocity of one charge and the acceleration of the other. When averaged over a circular orbit oriented at random, one such term gives a net force due to electrons accelerated in starting or stopping a longitudinal conduction current in a bar of magnetic material.

538.221 110

Magnetic behavior of molecularly dispersed iron. ANTONOFF, G. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 100 (*Aug.* 1 *and* 15, 1945).—If an Fe salt is electrolyzed with a Hg cathode, some of the Fe penetrates into Hg forming an amalgam, and some settles on the surface in form of small dendrites. A test tube just fitted into the gap between the poles of an electromagnet. Some Hg was inserted to act as a cathode. The test tube was filled with a saturated $FeSO_4$ solution and a soft iron anode inserted into the upper part. About 1A was passed. After a time amalgam near the surface was observed. Then application of magnetic force caused sinking of the amalgam and re-appearance of the free Hg surface. Observation of the Hg surface revealed deposits of small Fe particles near the two poles. Pole reversal produced no visible effect. The $FeSO_4$ solution was apparently in a moleculary dispersed state in the initial stages, and the effect was dipolar.

538.3 : 621.396.616 111

The resonator action theorem. MACLEAN, W. R. *Quart. Appl. Math.*, **2**, 329–35 (*Jan.*, 1945).—[Abstr. 2660 B (1945)].

538.311 : 621.318.4 112

Cube-surface coil for producing a uniform magnetic field. RUBENS, S. M. *Rev. Sci. Instrum.*, **16**, 243–5 (*Sept.*, 1945).—[Abstr. 133 B (1946)].

538.32 113

Action and reaction between moving charges. PAGE, L., AND ADAMS, N. I., JR. *Amer. J. Phys.*, **13**, 141–7 (*June*, 1945).—Calculates the mutual electromagnetic linear and angular momenta of two moving charges. These, together with the mechanical momenta, obey the law of conservation of momentum; apparent discrepancies in the law as applied to the latter only are due to neglect of the former, which are second order quantities, e.g. in the Trouton–Noble experiment. Other examples are also cited, relating to

electron motion and to a sphere which is both magnetized and charged. G. F. F.

538.65 = 4 114

Interpretation and connection of electrical effects of deformation and magnetization. PERRIER, A. *Helv. Phys. Acta.*, **17** (*No.* 7), 553–70 (1944).—A general theory of effects, one of which has been dealt with in a recent paper [see Abstr. 3020 (1945)]. The theory assumes the presence of spontaneous magnetization, striction and anisotropy, microphysical properties of matter which are manifested in a macroscopic manner. The connection between mechanical deformation and magnetic polarization takes place through the agency of spontaneous striction with consequent anisotropy of the constituent elements of the material. Deformation of the ferromagnetic medium is followed by rotation of the vector of spontaneous magnetization and the positions of equilibrium assumed by the vectors involved depend on the directions of symmetry of each crystallite and on spontaneous striction. G. E. A.

538.67 115

The electric counterpart of Oersted's experiment. EHRENHAFT, F. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 102 (*Aug.* 1 *and* 15, 1945).—An Alnico 5 magnet of 60 000 maxwells was fitted with 2 circular cylindrical pole pieces ending in truncated cones 5 mm dia. and 1·5 mm apart. The horizontal opposing pole faces were covered with a thin electrically insulating layer of Picein. The rotation of $Fe(OH)_3$ particles suspended in a cylindrical drop of $FeCl_2$ solution placed in the homogeneous field between the pole faces is observed to be counter-clockwise when looking at the S. pole and to be independent of the influence of light. On connecting the poles of the magnet with a piece of soft Fe of small cross-section, the rotation of the particles is slower. With a piece of larger cross-section the rotation ceases. Upon adding a trace of NH_4OH to the droplet, the rotation diminishes. With further addition it ceases and then reverses. This phenomenon cannot be explained by Biot–Savart–Lorentz force nor by Faraday–Quincke movements. If the magnetic vortex of Oersted is called the magnetic action of electric currents, the electric vortex should be called the electric action of magnetic currents.

538.67 116

Polarity of magnetism. EHRENHAFT, F. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 102 (*Aug.* 1 *and* 15, 1945).—In continuing earlier experiments a cell was used having separate compartments for the poles. With the electromagnet formed of one piece of Fe and dilute H_2SO_4 in the cell, a greater evolution of gas was observed when the magnetic field was in action than when the gas was evolved by chemical action alone. Whereas in the first experiments more O was detected in the gases evolved than could be accounted for by the air dissolved in the water, following the reports of J. T. Kendall and others the earlier experiments were repeated without duplicating the first results. In using a cell with one or two compartments, two kinds of gas bubbles were observed when the magnetic field was in action, the one circulating counter-clockwise when viewing the south pole, the other being repelled or attracted by one of the poles in the homogeneous part of the field. The first kind behave as if they bear an electric, the second a magnetic, charge. Both reverse with the field. From these observations it is concluded that magnetism must be described as a polar vector.

538.67 117

Magnetism as a polar vector. EHRENHAFT, F. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 105 (*Aug.* 1 *and* 15, 1945).—Two pole pieces of soft Swedish iron electrically insulated from one another could be attached to either one or two so-called permanent magnets of Alnico Blue Streak alloy, and their opposing pole faces immersed in 4% H_2SO_4. The potential differences between the pole pieces were measured by a potentiometer. With 2 magnets alternating with one magnet in position, the average of the successive readings taken at five-minute intervals was 0·0031 V with 2 magnets, and 0·0022 V with one magnet. In both cases north was positive. Thus the potential difference depends on the pole strength, and the polarity of magnetism is indicated. [See Abstr. 281 (1945)].

538.691 : 537.291 *see Abstr.* 87

538.691 : 537.533.72 *see Abstr.* 95

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539.13 : 541.571 *see Abstr.* 225

539.13 : 541.63 *see Abstr.* 229

539.132 : 539.155.2 *see Abstr.* 125–127

539.133 : 541.67 *see Abstr.* 233

539.152.1 118

On isotopic spin. NICOLSKY, K. *Phys. Rev.*, **67**, 366 (*June* 1 *and* 15, 1945).

539.152.1 119

Evidence of wide neutron groups. YALOW, A. A., AND GOLDHABER, M. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 99 (*Aug.* 1 *and* 15, 1945).—A systematic search for wide neutron groups used various methods (self-absorption, absorption in B, overlapping of levels; and combinations of these methods). Among the known groups of large total width the Ag (22 sec) B group and the Br (18 min and 4·4 hr) group were studied in detail and appear to be due to single wide levels. The B group was investigated by isolating it with a "double filter" of Cd + Au which removes *C* and *A* neutrons. A number of new cases of overlapping of neutron resonance levels of different elements were observed. Evidence for fairly wide levels in Re and Ir was obtained. With these elements as absorbers a considerable reduction is found in the activity produced by *R* neutrons in the following detectors: Mn (2·59 hr), As (26·8 hr), Br (18 min), Pd (13·0 hr), Ag [22 sec (B) and 2·3 min], I (25 min), W (24·1 hr).

539.152.1 120

Penetration of fast nucleons into heavy atomic nuclei. ROSENFELD, L. *Nature, Lond.*, **156**, 141–2 (*Aug.* 4, 1945).—Heisenberg's theory of the penetration of a fast nucleon into a heavy nucleus has given very

satisfactory results when used to calculate the range of the central potential on which the energy distribution of the nucleons knocked out by the impinging particle depends, assuming a law of force of the type $e^{-\psi^2 r^2}$. It is shown that Heisenberg's theory, in its simple form, is not applicable to nuclear potentials of other types for which the range has been determined from proton-proton scattering data, and particularly the potentials of the "well" and "meson" types. The inadequacy of the theory is apparent when the mean energy loss of the impinging nucleon per unit of path in nuclear matter is calculated by an extension of the Heisenberg method. A. J. M.

539.152.1 : 530.12 121

The relativistic correction in the meson theory of nuclear force. Hu, N. *Phys. Rev.*, **67**, 339–46 (*June 1 and 15, 1945*).—A systematic investigation is made on the relativistic corrections of the usual non-relativistic meson theories of nuclear force by expansion with respect to the dimensionless operator ∇/M. The inadmissible singularity which has been removed in the mixed theory in the non-relativistic region reappears in the higher approximations. This means that the extension of the mixed theory to the relativistic region is not justified.

539.152.1 : 539.172 122

The excitation of heavy nuclei. Wiedenbeck, M. L. *Phys. Rev.*, **68**, 1–4 (*July 1 and 15, 1945*).—A new metastable isomer of Au was found. The energy level system of Au was studied in the region from the threshold to 3·3 eMV. The energy of the metastable state was found to be approx. 250 ekV and higher activation levels which combine with the metastable state are found at $1{\cdot}22 \pm 0{\cdot}03$, 1·68, 2·15, 2·56 and 2·97 eMV, respectively. This excitation was also produced by fast neutrons by the Au-*n*-*n* reaction and the threshold for this process was determined. The previously known 43-minute period of Hg was produced by direct X-ray irradiation as well as a 42-day period in Nb. The Sr activity, known previously from neutron excitation, of 2·7 hrs $\frac{1}{2}$-life was produced by both X-ray and electron bombardment of this element.

539.153 : 537.533.8/.9 : 535.338.3 123

Probabilities of ionization and excitation of closed shell electron of Li by electron impact. Wu, T. Y., and Yu, F. C. *Chinese J. Phys.*, **5**, 162–79 (*Dec.*, 1944).—The quantum mechanical cross-sections for the excitation of the valence electron, an electron in an inner closed shell, and of the simultaneous excitation and ionization were calculated for the Li atom. Analytic wave functions, determined by the variational method, were used. The probability of excitation of an electron in a closed shell is generally very small compared with that for the excitation of the valence electron but is of the same order as those for the simultaneous excitation and ionization. Various experiments on electron collision and observations on the satellite lines in atomic spectra are discussed on the basis of the calculations. L. S. G.

539.155.2 : 535.336.2 = 3 124

Has a caesium isotope of long half-value time existed? A contribution to the explanation of unusual lines in mass-spectrography. Mattauch, J., Ewald, H., Hahn, O., and Strassmann, F. *Z. Phys.*, **120** (*Nos. 7–10*), 598–617 (1943).—The mass-spectrographic investigations of W. Wahl [*C. Scient. Fenn. Comm. Phys., Math. X*, 18 (1940)] on the geologically old Cs mineral pollucit, from Varnoträsk, are repeated in a somewhat modified form. The experiments and results are given in considerable detail. H. G. S.

539.155.2 : 539.132 125

The ratio rule. Edgell, W. F. *J. Chem. Phys.*, **13**, 306 (*July*, 1945).—[See Abstr. 1149 (1943)].

539.155.2 : 539.132 126

On the product rule. Edgell, W. F. *J. Chem. Phys.*, **13**, 377–8 (*Sept.*, 1945).—[See Abstr. 3938 (1936)].

539.155.2 : 539.132 127

Product rule applications. Halverson, F. *J. Chem. Phys.*, **13**, 533–4 (*Nov.*, 1945).

539.155.2 : 539.167.3 *see Abstr.* 143

539.155.2 : 541.127 *see Abstr.* 188

539.155.2 : 541.135 128

Efficiency of the electrolytic separation of chlorine isotopes. Hutchison, D. A. *J. Chem. Phys.*, **13**, 536–7 (*Nov.*, 1945).—[See Abstr. 2896 (1942)].

539.156 129

Short range interatomic forces. Horning, W., O'Connell, W., and Weinberg, J. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 106 (*Aug. 1 and 15, 1945*).—Because of the large momenta involved in the collision of ions with atoms, the corresponding elastic scattering may be analysed by classical mechanics. In experiments on the collision of A ions with H atoms at energies of the order of 100's of volts, the dependence of cross-section upon energy and scattering angle indicates the presence of a repulsive force of exclusion varying as $1/(\text{distance})^3$. At the distances of approach calculated from this force law, overlapping of the electron clouds of ion and atom takes place; and the average duration of a collision compared with atomic periods is such that the electron distribution has time to become adjusted to the influence of both nuclei. A Fermi–Thomas statistical model of the two-centre system should provide an approximation to the potential energy as a function of nuclear separation. This problem was solved by the variational method, for the case of two nuclei of equal atomic number; and the potential energy-function obtained is in agreement with the main features of the data.

539.16 : 666.1 130

A method of determining the percentage of potassium in glass by means of its natural radioactivity. Eklund, S. *Ark. Mat. Astr. Fys.*, **32 B** (*No. 3*), 6 *pp.* (1945).

539.16.08 131

On the radium content of a new mineral from Rajputana. Chaudhuri, B. D. N. *Indian J. Phys.*, **18**, 257–8 (*Oct.*, 1944).—The proportion by weight of U and Th in the mineral, determined by estimating the β-activity and the absorption in aluminium, was found to be 60% and 0·7% respectively. The Ra content was estimated and compared with the various Ra ores

from which Ra is at present extracted. The present ore seems suitable as a source of Ra.

539.16.08 : 550.4 *see Abstr.* 297

539.16.08 : 621.383 132

The multiplier photo-tube in radioactive measurements. BLAU, M., AND DREYFUS, B. *Rev. Sci. Instrum.*, **16**, 245–8 (*Sept.*, 1945).—[Abstr. 153 B (1946)].

539.16.08 = 3 133

The radium standards. WEISS, C. *Z. Phys.*, **120** (*Nos.* 7–10), 652–72 (1943).

539.16.08 : 539.17 : 539.185 = 3 134

The partition conditions and energies in uranium fission. FLAMMERSFELD, A., JENSEN, P., AND GENTNER, W. *Z. Phys.*, **120** (*Nos.* 7–10), 450–67 (1943).—A detailed description of the measurements of the energies of related U-fragments simultaneously detached on both sides from the U-layer under the action of slow neutrons and of the double ionization chamber and other instruments used. The frequency distribution of the resulting values of the energy pairs affords a better picture of the mechanism of nuclear fission than individual and total energy distributions. The results agree essentially with the Bohr and Wheeler theory [Abstr. 3979 (1939)]. H. G. S.

539.16.08 : 622 : 537.542 = 3 *see Abstr.* 100

539.16.088.4 135

Correction of G–M counter data. KURBATOV, J. D., AND MANN, H. B. *Phys. Rev.*, **68**, 40–3 (*July* 1 *and* 15, 1945).—It has been shown that the mean number $B(T)$ of discharges during any time T is given by $B(T) = \int_0^T [1 - p(t)]a(t)dt$, where $a(t)$ is the total density of radiation penetrating the tube at the time t and $p(t)$ is the solution of the integral equation: $p(t) = \int_{t-\tau}^{t} [1 - p(x)]a(x)d(x)$ for $t > \tau$ and $p(t) = 1 - e^{-at}$ for $0 \leqslant t \leqslant \tau$. $B(t)$ is explicitly obtained for the case that $a(t)$ is constant. In this case it is also shown that

$$aT = [B(T) - \eta]\{1 - [B(T) - \eta]\tau/\tau\}^{-1},$$
$$|\eta| \leqslant (a\tau)^2/\{1 - (a\tau)^2\}^{-1} \text{ for } a\tau < 1.$$

539.164 = 3 136

Energy and range of slow α-rays. HACMAN, D., AND HAXEL, O. *Z. Phys.*, **120** (*Nos.* 7–10), 486–92 (1943).—The energy/range relation for a range of 0·2 cm is determined by a method based on the measurement of a single α-particle. The results are plotted in a curve and agree with the Holloway and Livingston measurements [Abstr. 3201 (1938)].

H. G. S.

539.164 : 666.1/.2 = 3 137

Introduction of the emanation method in glass technology. ÅBERG, N. *Ark. Kemi Min. Geol.*, **18 A** 4–5 (*No.* 15), 9 *pp.* (1945).—The fusion of glasses with radio-thorium and the determination of the activity at different temperatures, enables the temperatures of sintering and fusion of powdered glass to be determined. The method can also be used to find the transformation interval of various glasses. The transformation interval is indicated by an approximately constant activity over the temperature range.

A. J. M.

539.164.81 = 3 138

The amount of ionization from radioactive recoil atoms. GERTHSEN, C., AND GRIMM, E. *Z. Phys.*, **120** (*Nos.* 7–10), 476–85 (1943).

539.164.9 : 548.7 *see Abstr.* 268

539.164.92 = 3 139

The ionization of individual α-rays in different gases. STETTER, G. *Z. Phys.*, **120** (*Nos.* 7–10), 639–51 (1943).—Ionization curves of single α-rays, obtained by two simultaneous registrations with a double valve electrometer, are given for N_2, air and Xe, together with corresponding tables of values of the residual range, ion growth, and total ionization for the evaluation of nuclear-physical investigations. The ionization variation, as well as the range scattering, grows with the atomic number, but the former considerably more quickly. H. G. S.

539.165 : 537.542 140

Thin-walled aluminium beta-ray tube counters. BROWN, B. W., AND CURTISS, L. F. *J. Res. Nat. Bur. Stand., Wash.*, **35**, 147–50 (*Aug.*, 1945).—A description is given of Al-tube Geiger–Müller counters having a wall thickness of 0·004 in and constructed from commercially available tooth-paste tubes. These tubes as furnished are in the hard temper and have uniform wall thickness, which enable them to stand complete evacuation without a tendency to collapse. By Cu-plating the Al it is possible to soft-solder fittings to the tube to construct a counter that can be permanently sealed after filling and that will maintain its characteristics over a long period. The procedure reduces the cost of making this type of counter, as the Al tubes are inexpensive, and very simple operations are required in the construction of the counters.

539.166.2 141

Width of nuclear levels. GOLDHABER, M. *Amer. Phys. Soc.* (*Proc.*, *June*, 1945). *Abstr. in Phys. Rev.*, **68**, 99 (*Aug.* 1 *and* 15, 1945).—An extension of the analysis of the width of the known RaC′ levels, based on earlier data, supports the view, recently expressed, that the max. γ-ray width has been underestimated in the past. Among the states of 2–3 eMV excitation energy, there appear to be several with a width of the order of a few eV, in contrast to the sharp states previously analysed, which have widths of the order of 10^{-3} eV. This suggests the possibility that some slow neutron groups of large total width, hitherto ascribed to an agglomeration of a large number of sharp compound nucleus states may be due to wide compound nucleus states. The larger values for the radiation width bring the Bohr theory of nuclear reactions into better agreement with experiment with respect to the probability of fast neutron capture and level density.

539.167.3 142

Radioactivity of active nitrogen. SIEGBAHN, K., AND SLÄTIS, H. *Nature, Lond.*, **156**, 568–9 (*Nov.* 10, 1945).—[See Abstr. 2024, 3971 (1939)].

539.167.3 : 539.155.2 143

Radioactive scandium. II. HIBDON, C. T., AND POOL, M. L. *Phys. Rev.*, **67**, 313–17 (*June* 1 *and* 15, 1945).—Sc^{47} has been reported to have a half-life of 2·62 days and to emit 1·1 eMV electrons. These observations are not confirmed. A new radioactive isotope has, however, been produced by bombarding Ca with α-particles and to some extent by bombarding Ca with deuterons and protons. It emits β-rays of 0·46 eMV and has a half-life of 3·4 days. The assignment is made to Sc^{47}.

Sc^{48} has been produced by the reactions $Ca^{48}(p, n)$, $Ca^{48}(d, 2n)$, $Ti^{48}(n, p)$ and $V^{51}(n, \alpha)$. From the $V^{51}(n, \alpha)$ reaction γ-rays of 1·33 eMV and β-rays of 0·57 eMV were observed and from the $Ca^{48}(p, n)$ reaction γ-rays of 1·35 eMV and β-rays of 0·57 eMV were observed. Relative saturation intensities are calculated for Sc^{43}, Sc^{44}, Sc^{47} and Sc^{48} when produced by proton, deuteron, α-particle and fast neutron bombardments. Sc^{48} was produced free of Sc^{44} by the $V^{51}(n, \alpha)$ and the $Ca^{48}(p, n)$ reactions. Electrons of 0·57 eMV and γ-rays of 1·33 eMV were observed. Sc^{48} emits approximately 14 γ-rays per electron. All reactions associated with the scandium region are schematically summarized in a nuclear transmutation chart.

539.169 : 542.921.9 *see Abstr.* 243

539.17 : 539.185 : 539.16.08 = 3 *see Abstr.* 134

539.172 : 539.152.1 *see Abstr.* 122

539.172.4 144

Disintegration of boron by slow neutrons. CHATTERJEE, S. D. *Indian J. Phys.*, **18**, 269–80 (*Oct.*, 1944).—The disintegration was investigated using an ionization chamber filled with boron trichloride in conjunction with a linear amplifier and loop oscillograph. The various factors which affect the size of oscillograph deflections and thereby introduce a distortion in the shape of the distribution curve are discussed. The experimental evidence points to a reaction energy of about 2·5 eMV. It appears that the transition to the ground state of $_3Li^7$ is forbidden, and that the reaction leads to an excitation state in the $_3Li^7$ nucleus, with different angular momentum for which the transition is allowed.

539.172.4 145

Search for (n, α)-reaction in rare earth elements with slow neutrons. ARNETT, H. D., SCHARFF-GOLDHABER, G., AND KLAIBER, G. S. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 100 (*Aug.* 1 *and* 15, 1945).—The attempt was renewed to detect γ-emission from Sm under the action of slow neutrons, and the work was extended to a number of neighbouring elements. Some improvements in technique were made and the arrangement calibrated with the B^{10} (n, α)-reaction. No α-emission could be detected for C neutrons within the limits of experiment. For Sm and Gd $r < 10^{-4}$. If the sharp levels were compound nucleus levels with a width $\leqslant 0{\cdot}1$ eV and assuming $E \geqslant 8$ eMV a theoretical estimate is $r \gtrsim 10^{-3}$.

539.18 : 537.59 146

On the evidence for the existence of neutral mesotrons. SIRKAR, S. C., AND BHATTACHARYYA, P. K. *Phys. Rev.*, **67**, 365 (*June* 1 *and* 15, 1945).

539.185 147

Thermal neutron scattering studies in metals. NIX, F. C., AND CLEMENT, G. F. *Phys. Rev.*, **68**, 159–62 (*Oct.* 1 *and* 15, 1945).—The interaction of slow or C neutrons can be modified by changes in the physical parameters of the material which the neutrons are traversing. Measurements of the effect of grain size on *total* C neutron cross section were made on randomly-oriented poly-crystalline Fe and Cu. In the case of Cu it was found that the total cross section decreased in an exponential manner with increase in grain size. For Fe it was simply established that the total cross section was substantially smaller for the larger grain size.

539.185 : 537.534.74 148

Neutron-proton scattering at 8·8 and 13 eMV. BUNGE, M. *Nature, Lond.*, **156**, 301 (*Sept.* 8, 1945).

539.185 = 3 149

On the principle of the method of neutron probes. BOTHE, W. *Z. Phys.*, **120** (*Nos.* 7–10), 437–49 (1943).—The errors likely to arise in making comparative probe measurements of neutron densities and currents depend upon probe orientation, neutron energy and properties of the probe and surrounding medium. Measurements with Dy-probes in paraffin and Al agree with the calculations. Formulae for estimating the errors are given. H. G. S.

539.185 : 539.17 : 539.16.08 = 3 *see Abstr.* 134

539.185.7 = 3 150

On the absorption of neutrons in aqueous solutions. HAXEL, O., AND VOLZ, H. *Z. Phys.*, **120** (*Nos.* 7–10), 493–512 (1943).—By means of activity measurements of aqueous solutions of $AgNO_3$ in relation to Ag concentration and Cd additions comparisons are made of the absorption cross-section for thermal neutrons of Cd, H_2 and Ag. Giving Cd the value $\sigma_{cd} = 3\,300 \times 10^{-24}$ cm^2, then $\sigma_H = 0{\cdot}24 \times 10^{-24}$ cm^2 and $\sigma_{Ag} = 55 \times 10^{-24}$ cm^2. The probability of capture of neutrons in the resonance region of Ag was found to be proportional to the square root of the Ag concentration. H. G. S.

539.185.9 : 615.84 = 4 151

Biological effects and possible therapeutic applications of neutrons. MALLET, L. *J. Radiol. Electrol.*, **24**, 247–54 (*Nov.–Dec.*, 1941).—Reviews the production of neutrons and their relative equivalence with Ra, with details of artificially produced radioactive elements. Their present and future uses in physiology and therapy as "tracers," etc., are briefly mentioned. B. J. L.

STRUCTURE OF SOLIDS 539.2

539.2 : 548.7 152

Molar polarization and radius-ratio of ions. LEE, F. H. *Nature, Lond.*, **155**, 698–9 (*June* 9, 1945).—The non-additivity of interionic distance in the crystalline state was explained by Fajans in terms of polarization, and by Pauling as the effect of the

radius-ratio, ρ, of the constituent cation and anion. A set of empirical equations concerning molar volumes and molar refractions of alkali-halides is presented, and from these equations definite values are assigned to polarization, and a function of ρ is obtained which, though different in form from Pauling's function, gives identical values. N. M. B.

539.21 : 621.892.261 153

Lubricating greases. LAWRENCE, A. S. C. *J. Inst. Petrol.*, **31**, 303–14 (*Aug.*, 1945).—Many soaps, when heated in an oil of sufficiently high b.p., form a fluid solution when hot, which sets to a clear gel on cooling to a temperature T_1. At some lower temperature T_2, it becomes opaque and forms a suspension of microcrystals of the soap. When heated alone, the soap melts at a high temperature to form a normal liquid. On cooling, this passes at T_1 to a plastic or resinous state which continues to increase in viscosity as it cools further. At T_2 it undergoes a sharp transition to a microcrystalline solid. At this change the viscosity of the plastic phase is very great and the crystals are minute. A table is given of metals classified according to whether their soaps do, or do not, gelate. The soaps which do not, have the lower m.p.s. and are usually soluble in organic solvents, crystallising like fatty acids on cooling. The gelating soaps are only soluble in organic solvents if their b.p. $> 150°$C. Peptizers, such as water, glycerine, or a fatty acid, lower the temperatures T_1 and T_2, and at the setting point of the mixture, the soap separates separately, and the peptizer, if liquid and sufficiently soluble, remains in solution in the oil. A. C. W.

539.215.2 : 771.5 154

The relationship between the granularity and graininess of developed photographic materials. JONES, L. A., AND HIGGINS, G. C. *J. Opt. Soc. Amer.*, **35**, 435–57 (*July*, 1945).—The objective quantity, "granularity," which refers to the spatial variations in transmitting or reflecting characteristics of a developed photographic material, was determined for a group of materials differing widely in sensitivity and grain size. The psychophysical quantity, "graininess," which refers to the visual appearance of the granular structure in a developed photographic material, was measured on the same samples by the method proposed by Jones and Deisch. None of the methods of measuring granularity give the same functional relation between granularity and the density of the Ag image as that existing between graininess and density. However, by choosing arbitrarily a density level which is not the same for all of the objective methods, they can be made to give granularity values which place the different photographic materials in approx. the same order as the graininess values, but for no method is the order exactly the same. Moreover, even when the order is the same, the granularity values are not proportional to the graininess values. These results show that the objective methods measure one or more, but not all, of the factors which determine graininess.

539.216 : 674.8 : 676 155

Factors influencing paper strength. V. Chemical characteristics of wood pulps. HEBBS, L. *Proc. Tech. Sect. Paper Mkrs' Ass.*, **25**, 224–8 (*Dec.*, 1944).—No simple characterization of wood pulps, as at present normally determined, can be held responsible for the development of strength; all the analytical characteristics must be correlated and considered in conjunction with pulp production conditions and the origin of the wood. The max. strength development in bleached pulps is achieved by simultaneously (as far as possible), (1) removing the lignin selectively, without damaging the cellulose; (2) maintaining the viscosity as high as possible; (3) reducing the hemicelluloses content to a level consistent with (2). In addition, the max. strength obtainable depends on the morphological character of the ultimate fibre, and in particular, on the presence of a min. proportion of cell wall. [See Abstr. 6 B (1946)]. J. G.

539.216 : 677.46 *see Abstr.* 345

539.216.1 : 677.31 156

Scaliness of wool fibres. MENKART, J., AND SPEAKMAN, J. B. *Nature, Lond.*, **156**, 143 (*Aug.* 4, 1945).—[See Abstr. 2383 (1945)].

539.217 : 532.71 : 541.8 *see Abstr.* 237

539.217 : 621.798.15 *see Abstr.* 334

539.217.3 : 541.183.2 : [621.315.617.3 + 621.315.616.96] 157

Permeation and sorption of water vapour in varnish films. THOMAS, A. M., AND GENT, W. L. *Proc. Phys. Soc., Lond.*, **57**, 324–49 (*July*, 1945). *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. A/T92*, 19 *pp.* (1944).—An experimental investigation on the moisture permeability and sorption of detached varnish and polystyrene films is described. Details for preparation of samples and methods of test, under various conditions of v.p. and temp., are given. Both the permeability and sorption of the films were determined at constant moisture concs., that is, by using streams of moist air, the amounts permeating and the amounts sorbed being directly weighed. In addition to moisture permeability, some measurements of that of H_2 and CO_2 are reported. Consideration of the experimental results shows that they can be interpreted by assuming that the diffusion process is analogous to that of substances in solution. There is insufficient evidence to show the effect of v.p. and temp. on the moisture permeability, but the results for CO_2 and H_2 indicate that the diffusion process is dependent on the microphysical properties of the film. The effect of structure on diffusion is discussed, and the relations of the results to the problems of electrical insulation are considered.

539.23 : 548.73 *see Abstr.* 283

539.234 158

Techniques for evaporation of metals. OLSEN, L. O., SMITH, C. S., AND CRITTENDEN, E. C., JR. *J. Appl. Phys.*, **16**, 425–31 (*July*, 1945).—The evaporation behaviour of 34 elements was observed, the results being summarized for each element and the best techniques listed. W, Fe, Ni and chromel wires were used and these were formed into close wound conical baskets and helical coils. Alundum and BeO crucibles formed by painting suspensions of these materials on a tungsten conical basket followed by baking at a high temperature were exceptionally

satisfactory heaters for almost all of the elements studied.

539.26 159

Electron radiography using secondary β-radiation from lead intensifying screens. TASKER, H. S., AND TOWERS, S. W. *Nature, Lond.*, **156**, 50–1 (*July* 14, 1945).—Radiographs of thin and easily penetrated materials may be obtained with ordinary high voltage X-rays by placing the object between a lead screen and a photographic emulsion in an X-ray cassette. The secondary β-radiation emitted from the lead gives the photograph on the emulsion. The best conditions, types of plate, etc., are described, as well as certain difficulties which may arise in particular circumstances. J. W. T. W.

539.26 : 535.42 160

Composition and diffraction effects in X-ray microradiographs. HURD, J. M., LUCHT, C. M., AND SMOLUCHOWSKI, R. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 100 (*Aug.* 1 *and* 15, 1945).—A fine grain photographic emulsion allows the use of medium high magnifications (100 to 200). Variation of composition between various constituents can be detected and gradients within a solid solution observed. The gradients are almost undetectable by other methods. Depending upon the orientation of a grain, sets of crystallographic planes diffract the radiation and affect the transmitted intensity. Along grain boundaries, dark and light lines and shadows are observed which are also explicable as a diffraction effect.

539.26 : 541.182.02 161

X-ray study of the solution of alkali halides in borax and B_2O_3 glass systems. MAJUMDAR, S. K., BANERJEE, B. K., AND BANERJEE, K. *Nature, Lond.*, **156**, 423 (*Oct.* 6, 1945).

539.266 : 537.531 : 535.42 162

Diffraction of X-rays by aqueous solutions of hexanolamine oleate. ROSS, S. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 107 (*Aug.* 1 *and* 15, 1945).—Solutions of conc. 25–92% by wt. of soap were examined. As they become more dilute, the long spacing increases linearly from a value of 54 Å at 92% to 135 Å at 30% solute. The value of the side-spacing is about 4·6 Å independent of changes of conc. Solutions of <60% show 2 orders of the long spacing, corresponding to the 002 and 004 diffraction orders. The linear relation holds over a range of conc. in which great changes in viscosity and anisotropy take place. It is shown that changes of viscosity and gel/sol transitions in soap solutions are due to rearrangements of the primary micelles with respect to each other. The internal structure of the micelle itself is meanwhile independently maintained. The presence of lamellar micelles in aqueous solutions of this colloidal electrolyte is proved.

ELASTICITY . STRENGTH . RHEOLOGY
539.3/.8

539.313 163

Stresses in soils under a foundation. WEISKOPF, W. H. *J. Franklin Inst.*, **239**, 445–65 (*June*, 1945).—An analysis to find the stresses in a semi-infinite substance in which the ratio of the compression modulus to the shear modulus, E/G, is greater than the corresponding ratio for solids. E/G becomes a soil constant which can be evaluated for different soils; the tentative value for sand is 5·35. The analysis is developed first for problems in 2 dimensions and then in 3, and some applications to particular loadings are indicated. In the above field the discrepancies between theory and actual conditions are great, and the paper is an attempt to reduce this wide gap. G. E. A.

539.32 : 678.1 : 677 *see Abstr.* 344

539.37 164

On the treatment of discontinuities in beam deflection problems. KOSKO, E. *Quart. Appl. Math.*, **2**, 271–2 (*Oct.*, 1944).—It is shown that the method of a previous paper [Abstr. 1997 (1945)] is equivalent to one introduced many years ago in England. L. S. G.

539.37 165

On the treatment of discontinuities in beam deflection problems. CAIN, B. S. *Quart. Appl. Math.*, **2**, 353 (*Jan.*, 1945).—Correspondence relating to a detail in the mathematical procedure in a previous paper [Abstr. 1997 (1945)]. L. S. G.

539.385 : 621.317.39 : 620.175.22 166

Torsional vibration amplitudes at non-resonant speeds. WILSON, W. K. *Proc. Instn Mech. Engrs*, **153** (*War Emerg. Issue No.* 3), 83–108 (1945).—[Abstr. 12 B (1946)].

539.4.01 : 539.56 *see Abstr.* 174

539.4.011.2 : 676 : 620.172.224.1 167

Factors influencing paper strength. I. Stress/strain curves of paper. GIBBON, E. R. *Proc. Tech. Sect. Paper Mkrs' Ass.*, **25**, 199–210 (*Dec.*, 1944).—[Abstr. 8 B (1946)].

539.4.013 : 669.14 168

Yielding and fracture of medium-carbon steel under combined stress. DAVIS, E. A. *J. Appl. Mech.*, **12**, *A*13–*A*24 (*March*, 1945).—Results of combined stress tests on a medium-carbon steel are given. The effect of the shape of the test specimen and the isotropy of the material upon the rupture properties are investigated.

539.4.016 : 666.1.037.5 *see Abstr.* 336

539.4.016 : 666.1.037.5 : 621.326.646.7 169

Glass-to-metal seals, with particular reference to current lead-in seals in vacuum devices. DOUGLAS, R. W. *J. Soc. Glass. Tech.*, **29**, 92–110 (*April*, 1945).—[Abstr. 138 B (1946)].

539.4.016 : 666.189.3 *see Abstr.* 338

539.41 = 82 170

Rigidity. ALEXANDROFF, A. P. *Vestn. Akad. Nauk USSR* (*Nos.* 7–8), 51–7 (1944).—Griffiths' conception of rigid breakdown is discussed. This explains the large discrepancies between practical and theoretical strengths, and is confirmed by Zhurkov and Grebenshtchikov. Hyperbolae are drawn showing the gradual process of surface breakdown. Stepanoff's hypothesis on monocrystal salts is considered. S. S.

539.5 : 679.5 : 620.171 171

Objective laboratory testing of the processability of elastomers. WHITE, L. M., EBERS, E. S., AND SHRIVER, G. E. *Industr. Engng Chem.*, **37**, 767–9 (*Aug.*, 1945).—[Abstr. 3 B (1946)].

539.501 : 655.3 172

The relationship between the rheological properties and working properties of printing inks. BUCHDAHL, R., AND THIMM, J. E. *J. Appl. Phys.*, **16**, 344–50 (*June*, 1945).—It is shown that the working properties of a printing ink, i.e. its performance during the printing operation, can be interpreted in terms of the rheological properties as measured in a rotational viscosimeter. Data are presented to show that it is necessary to distinguish between time-dependent and time-independent flow phenomena. Various theories suggested to explain the latter are discussed briefly. The flow of a printing ink over the main mechanical elements of a typographic printing press is analysed and correlated with simple flow phenomena.

539.501 : 679.5 173

A high temperature, high pressure rheometer for plastics. NASON, H. K. *J. Appl. Phys.*, **16**, 338–43 (*June*, 1945).—A modified Bingham-type rheometer, designed for operation at temperatures up to 500°F and at pressures up to 2000 lb/in² is described. Interchangeable orifice plates permit wide variation of shear conditions. With this instrument flow properties may be studied under conditions approximating those encountered in the actual processing of thermoplastics, e.g. by moulding or extrusion. Typical results are presented for cellulose acetate, polystyrene, and polyvinyl resin plastics, and correlation with practical experience is pointed out. The instrument is slow, and this limits its usefulness for other than research investigations.

539.56 : 539.4.01 174

Strength of glass and duration of stressing. PRESTON, F. W. *Nature, Lond.*, **156**, 55 (*July*, 1945).

PHYSICAL CHEMISTRY 541

REACTION KINETICS 541.121/.128

541.122.3 : 536.7 : 532.74 *see Abstr.* 41

541.123.012.4 175

Equilibrium between solid ferrous chloride and gaseous hydrogen sulphide at intermediate temperatures. LUKES, J. J., PRUTTON, C. F., AND TURNBULL, D. *J. Amer. Chem. Soc.*, **67**, 697–700 (*May*, 1945).—The equilibrium relationships between solid $FeCl_2$ and gaseous H_2S were studied over the range 620–733°K. Pyrrhotite (a solid solution of S in FeS) is formed in preference to FeS from 620–706°K, and equilibrium constants were determined for the reaction $FeCl_2(s) + 1{\cdot}14H_2S(g) = FeS_{1{\cdot}14}(s) + 2HCl(g) + 0{\cdot}14H_2(g)$ over this range. The relationship $\log_{10}K_p = (-4\,320/T) + 6{\cdot}71$ applies for these temps. W. R. A.

541.123.2 : 669.71.26 *see Abstr.* 342

541.123.21 176

The system lead chloride–water at 15° to 35°. GOULDEN, T. P., AND HILL, L. M. *J. Chem. Soc.*, 447–8 (*July*, 1945).—The solubility of $PbCl_2$ in water was redetermined for the temp. range 15–35°C; the following average results were obtained (g per 100 g of saturated solution): 15°, 0·866; 20°, 0·968; 25°, 1·075; 30°, 1·179; 35°, 1·298. Determinations of Pb and Cl in these solutions showed a slight excess of the latter equivalent to about 0·004 g of $PbCl_2$.

541.123.21 : 542.48 177

Composition of vapors from boiling binary solutions. OTHMER, D. F., AND BENENATI, R. F. *Industr. Engng Chem.*, **37**, 299–303 (*March*, 1945).—Three binary systems were studied at atmospheric and subatmospheric pressures. The data are correlated with one another and with published values by logarithmic plots.

541.123.23 178

The system octadecylamine–acetic acid. POOL, W. O., HARWOOD, H. J., AND RALSTON, A. W. *J. Amer. Chem. Soc.*, **67**, 775–6 (*May*, 1945).—The temp.-conc. curve for the system octadecylamine–acetic acid was followed over the complete conc. range. The existence of the new compound $C_{18}H_{37}NH_2 . 2HC_2H_3O_2$, m.p. 60·8°, was shown, and 3 modifications of this compound and of $C_{18}H_{37}NH_2 . HC_2H_3O_2$ were shown to occur. W. R. A.

541.123.31 179

The system ammonium selenate–cupric selenate–water at 25°C. KING, G. E., AND BECKMAN, W. A. *J. Amer. Chem. Soc.*, **67**, 857–9 (*May*, 1945).—Solubility relationships at 25°C were determined. The stable phase over almost the whole range of concs. is the double salt hydrate $(NH_4)_2SeO_4 . CuSeO_4 . 6H_2O$. W. R. A.

541.123.31 180

The system aniline–phenol–water. CAMPBELL, A. N. *J. Amer. Chem. Soc.*, **67**, 981–7 (*June*, 1945).—The isotherms for 8·6°, 25·4°, 48·0°, 66·3°, 69·6° (partially) and 96·7°C were determined by conductometric analysis of the equilibrium layers. Mutual solubility curves, the equilibria with solid phases where they exist, and the ternary eutectics were investigated. The v.p. isotherms for 48·0°, 66·3° and 96·7°C were measured and agree with the distillation curves obtained. The experimental data are discussed. W. R. A.

541.123.31 181

Solubility data for the system aniline–toluene–water. SMITH, J. C., AND DREXEL, R. E. *Industr. Engng Chem.*, **37**, 601–2 (*June*, 1945).—Solubility data are given for the ternary system aniline–toluene–water at 25°C. The distribution between organic and aqueous phases is correlated by an empirical exponential function, which fits the data more closely than a hyperbolic function of the type developed by Varteressian and Fenske [*ibid.*, **29**, 270 (1937)].

541.123.33 182

The solvent effect of lithium acetate on zinc acetate in acetic acid. GRISWOLD, E., AND HORNE, W. V. *J. Amer. Chem. Soc.*, **67**, 763–4 (*May*, 1945).—The

solubility of $Zn(OAc)_2$ in solutions of LiOAc in AcOH (conc. 2·5 to 12·5 mol. % of LiOAc) was determined over the temp. range 14–95°c. As long as the solid phase is unsolvated $Zn(OAc)_2$, its solubility increases with increased concentration of LiOAc. The ternary compound $Zn(OAc)_2 . 2LiOAc . 4AcOH$ is described. Similarities in the effects of LiOAc and of Na and NH_4 acetates are discussed as are also the differences in the behaviour of LiOAc and $LiNO_3$. The observed solvent effect is ascribed mainly to specific chemical reaction, analagous to the effect of strong bases in aqueous solutions upon $Zn(OH)_2$.

W. R. A.

541.124 : 541.183.022 183

Reactions in monolayers. Rideal, E. K. *J. Chem. Soc.*, 423–8 (*June*, 1945).—The Liversidge lecture in which a review is given of the chemical behaviour of the orientated monolayer of the boundary state with reference to its importance in biological processes, methods of following chemical changes at the interface, the effect on the reaction velocity of altering the molecular orientation by expansion or compression of the monolayers, and the influence of alterations in the energy of activation or the entropy and the steric factor on the reaction velocity. N. M. B.

541.124 : 542.952 : 541.182.4 *see Abstr.* 208, 209

541.124 : 77.012 184

The charge effect in relation to the kinetics of photographic development. I. The general effect. II. The induction period. James, T. H. *J. Franklin Inst.*, **240**, 15–24 (*July*), 86–96 (*Aug.*, 1945).—The charge barrier protecting the grain surface does not play the fundamental rôle once supposed in the mechanism of development, although its modifies the kinetics of development by ionic agents. The effectiveness of the charge barrier in protecting the grain surface from contact with the developer ions depends both upon the magnitude of the electric potential and the ionic charge. The kinetic effects now investigated fall into two somewhat overlapping groups: (1) Those produced primarily by a general action or by a general change in the magnitude of the barrier. To this group belong: the accelerating action which neutral salts under certain conditions exert upon development; the accelerating action of some dyes such as phenosafranin and pinacyanol; and the variation in the relative rates of development by agents of similar structure but different charge. (2) Those which originate from a localized change in the barrier occurring in the vicinity of the growing silver specks. In this group belong the induction period in development and various effects derived from the induction period such as the increase in emulsion speed (for incomplete development) obtained when sulphite is added to solutions of charged agents, the excessively high contrast obtained under certain circumstances when development is carried out in a caustic hydroquinone solution in the absence of sulphite, and the special properties of certain complex developers.

H. H. HO.

541.124 : 77.012 185

The charge effect in relation to the kinetics of photographic development. III. The abnormal behaviour of sulphite-free caustic hydroquinone developers. James, T. H. *J. Franklin Inst.*, **240**, 229–40 (*Sept.*, 1945).—This paper deals only with results obtained with the simple caustic hydroquinone developer used in combination with positive-type photographic films. It is shown that the abnormal characteristics are the result of localized changes in the magnitude of the charge-barrier surrounding the silver halide grain, and that a variation in the induction periods of development of the individual grains is involved. The photographic materials employed contained no optical sensitizer, and the abnormal characteristics of the sulphite-free hydroquinone developer were most noticeable when the developing agent was used in a caustic solution containing potassium bromide; optimal results were obtained with a solution of hydroquinone (0·005M), potassium hydroxide (0·05M) and potassium bromide (0·0067M). Abnormal development could also be obtained with certain other sulphite-free developers such as chlorohydroquinone, bromohydroquinone, and *p*-hydroxyphenylglycine. A connection between the peculiarity of the caustic hydroquinone development and the oxidation product formed is demonstrated. Resorcinol is less efficient than sulphite in eliminating the quinone formed during development. In the absence of bromide, development proceeds to a well-defined maximum. The more stable homologues of quinone are much less effective than quinone itself in accelerating development by their hydroquinones, and this suggests that the dismutation product is at least the more important accelerator. H. H. HO.

541.124.7 186

Collisional deactivation of excited ethylene molecules. Line, D., and LeRoy, D. J. *J. Chem. Phys.*, **13**, 307–8 (*July*, 1945).

541.127 187

The dissociation constants of some symmetrically disubstituted diphenylselenium dibromides. McCullough, J. D., and Eckerson, B. A. *J. Amer. Chem. Soc.*, **67**, 707–8 (*May*, 1945).—Constants for the dissociation of a number of symmetrically disubstituted diphenylselenium dibromides into the substituted Ph_2Se and Br_2 were determined spectrophotometrically, and values for the heats of dissociation of the *p*-Cl, *p*-Br and *p*-Me compounds calculated. The dissociation is sensitive to changes in electron density about the Se atom. The plot of the logs of the dissociation constants against the substitution constants (σ values) of Hammett is linear. Molar extinction coefficients for several dibromides and the corresponding selenides are listed. W. R. A.

541.127 : 539.155.2 188

Kinetics of the isotopic exchange reaction between carbon monoxide and carbon dioxide. Brandner, J. D., and Urey, H. C. *J. Chem. Phys.*, **13**, 351–62 (*Sept.*, 1945).—The rate of exchange of the C^{13} isotope between CO and CO_2 was studied. It was found to be a surface catalyzed reaction on quartz, Au and Ag surfaces. Within the limits of experimental error, which are rather large because of change of surface activity, the reaction is independent of pressure and composition of the gas mixture. The exchange is accelerated by H_2 or water vapour. O_2 produces a rapid initial exchange attributed to a chain

process of oxidation of CO, but is without effect on the subsequent exchange. Isotope exchange takes place with a velocity convenient for study around 300°C, and at this temperature the apparent energy of activation is about 100 kcal. Several mechanisms for the exchange of C^{13} were examined. One of them accounts for the experimental data and assumes the presence of H and OH molecules (or other activated forms of H_2 and H_2O) on the surface with the condition that the total amounts of these molecules is constant.

541.127 : 542.952 *see Abstr.* 244

541.127 : 542.952.6/.7 189

Note on the kinetics of systems manifesting simultaneous polymerization–depolymerization phenomena. BLATZ, P. J., AND TOBOLSKY, A. V. *J. Phys. Chem.*, **49**, 77–80 (*March*, 1945).

541.127.2 : 614.4 190

The law of mass action in epidemiology. II. WILSON, E. B., AND WORCESTER, J. *Proc. Nat. Acad. Sci., Wash.*, **31**, 109–16 (*April*, 1945).—A continuation of earlier work [Abstr. 2462 (1945)]. Oscillations in epidemics are considered and application is made to some statistical data concerning measles in the U.S.A.

L. S. G.

541.127.3 : 537.52 191

"Zero order" reactions under electric discharge. JOSHI, S. S. *Curr. Sci.*, **14**, 175 (*July*, 1945).

ELECTROCHEMISTRY 541.13

541.132 192

Normal and complex ionization of organic molecules in solvent sulphuric acid. I. Methyl 2,4,6,-trimethylbenzoate; *o*-benzoylbenzoic acid and its normal and pseudo-methyl esters. NEWMAN, M. S., KUIVILA, H. G., AND GARRETT, A. B. *J. Amer. Chem. Soc.*, **67**, 704–6 (*May*, 1945).—The van't Hoff *i* factors of methyl 2,4,6,-trimethylbenzoate, *o*-benzoylbenzoic acid, and its normal and pseudo-Me esters in solvent H_2SO_4 were determined cryoscopically, and correspond closely with the predicted values of 5, 4, 2 and 5, respectively. The theoretical considerations leading to the predicted values are discussed. W. R. A.

541.132.3 193

An improved glass electrode cell assembly. COATES, G. E. *J. Chem. Soc.*, 489–90 (*July*, 1945).

541.133 194

The electrical conductance of aqueous solutions. II. Lithium, sodium and potassium perchlorates at 25°C. JONES, J. H. *J. Amer. Chem. Soc.*, **67**, 855–7 (*May*, 1945).—The electrical conductances and the densities of aqueous solutions of Li, Na and K perchlorates were determined at 25° over the range of concentration 0·0005 to 0·1 molar. Using the known conductances of the cations the mobility of the perchlorate ion was calculated. W. R. A.

541.133 : 532.133 195

The application of Stokes' law to the electrical conductivity of organic ions. GONICK, E. *Amer. Phys. Soc.* (*Proc.*, *July*, 1945). *Abstr. in Phys. Rev.*, **68**, 105 (*Aug.* 1 *and* 15, 1945).—The application of Stokes' law to the ionic conductances of univalent ions leads to the following equation for λ, the limiting equivalent conductance of the ions

$$\lambda = (e.96\,500 \times 10^7)/6\pi\eta r \quad . \quad . \quad . \quad (1)$$

This equation is shown to be applicable to organic ions, and the effective radius, r, is shown to be $\propto$ a fractional power of the number of C atoms contained in the ions, provided none of these is a substituted C, the value of this fractional power depending on the type of ion. From Eq. (1) equations are developed from which the van der Waals radius of the CH_2 radical and substituted methylenes may be calculated. The value for the CH_2 radical agrees with that from crystallographic data. An equation is developed by which the limiting equivalent conductances of organic ions can be calculated. The method applies to ions containing unsaturated linkages and substituted methylenes and to saturated, unsubstituted ions. The conductivity of the hexanolammonium ion is calculated and is found to agree with the experimental value.

541.133 = 4 196

Conductivity of some mixtures of mineral acids RO_3H_3 and of organic polyhydroxy-derivatives. KOHLER, P. *Arch. Sci. Phys. Nat.*, **26**, 157–79 (*Sept.–Oct.*), 183–94 (*Nov.–Dec.*, 1944).—Section II deals with the individual properties of the various compounds studied, viz. aluminium hydroxide, boric acid, arsenious and antimonious acids and various organic substances, and also with details of the experimental work undertaken with them. Section III describes and discusses the variations of conductivity of mixtures of aluminium hydroxide with polyhydroxy organic reagents such as glycerine, glycol, mannite, glucose, lactic and pyruvic acids and catechol. Section IV extends the work to mixtures of boric, phosphorous, arsenious and antimonious acids and aluminium hydroxide with lactic and pyruvic acids, glucose, acetoacetic ester, catechol and pyrogallol. 12 tables of data are included. Section V discusses the behaviours of the reagents RO_3H_3, which are illustrated by 44 diagrams, e.g. the reverse effect of aluminium hydroxide to that of boric acid, the dihydroxy-action of phosphorous acid, and various complex formations which arise in the mixtures.

H. H. HO.

541.133.08 : 621.317.33.082.75 : 621.396.615 197

A device for indicating small changes in electrolytic resistance. BLAKE, G. G. *J. Sci. Instrum.*, **22**, 174–6 (*Sept.*, 1945).—Variations in the "*Q*" of an oscillator occur when a resistance capacitively coupled in parallel to it is varied. Using this effect, differences in the electrolytic resistance of solution concentrations are determined by a zero-shunted μ-ammeter in the plate-current feed. Curves are given for a liquid column of fixed dimensions for two solutes showing variation of solution concs. with corresponding plate-current variations; there is a critical resistance value beyond which energy losses diminish. By suitable spacing between electrodes on the outside of a glass tube filled with the solution under test, the same value of the plate-current is obtainable for any solution. An application is described for indicating changes in the electrolytic resistance of a solution flowing through a pipe system. When sufficient change takes place in

the conc. a relay operates, the liquid flow is stopped and a call-bell rings. A new type of relay and flow-control valve are described.

541.134 198

The first ionization of carbonic acid in aqueous solutions of sodium chloride. HARNED, H. S., AND BONNER, F. T. *J. Amer. Chem. Soc.*, **67**, 1026–31 (*June*, 1945).—E.m.f.s of the cells H_2, $CO_2|NaHCO_3(m_1)$, $NaCl(m_2)$, $CO_2(m_3)|AgCl–Ag$ were determined at 5° intervals from 0 to 50°, and at 5 const. NaCl concs., and from these the ionization functions $m_H \cdot m_{HCO_3}/m_{CO_2}$ or $K_{(S)}$, were calculated from 0 to 1M NaCl conc. Equations for calculating $K_{(S)}$ as a function of temperature were derived and by their use the free energy, heat content, heat capacity, and entropy of ionization may be evaluated. Equations valid from 0–50°C and 0–1M, are given by means of which $[-\log K_{(S=0)}]$, $[-\log K_{(S)}]$, the molalities, m_H and m_{CO_2}, and the activity coefficients, $\gamma_H\gamma_{HCO_3}/\gamma_{CO_2}$ can be calculated. Estimates of the accuracy of these computations in solutions containing both $NaHCO_3$ and NaCl were made. W. R. A.

541.134 199

Polarographic reduction potentials of quaternary ammonium ions. VAN RYSSELBERGHE, P., AND MCGEE, J. M. *J. Amer. Chem. Soc.*, **67**, 1039–40 (*June*, 1945).—Polarographic reduction was studied using NMe_4Br as supporting electrolyte. The accurately determined limiting tangent potential for the reduction of the NMe_4 is $-2{\cdot}93 \pm 0{\cdot}03$ V *vs.* the saturated Hg_2Cl_2 electrode. The reduction potential of the most reducible group in unsymmetrical ions is affected by the presence of the other groups. The reductions studied probably result in the formation of an amine and a hydrocarbon in the case of the tetra-alkylammonium ions, EtOH in the case of choline, and EtOAc in the case of acetyl choline.

W. R. A.

541.134 200

The standard electrode potential of magnesium. COATES, G. E. *J. Chem. Soc.*, 478–9 (*July*, 1945).—The standard electrode potential (E_0) of Mg has an important bearing on the various proposed corrosion mechanisms. A new value, $-2{\cdot}375 \pm 0{\cdot}005$ volts, has now been calculated from precise thermal data and from the activity product of $Mg(OH)_2$.

541.135 : 539.155.2 *see Abstr.* 128

541.135 : 545.84 : 541.183 *see Abstr.* 211

541.135.6 : 545.37 *see Abstr.* 252

541.138 : 621.357.7 201

The electrodeposition of element 43 and the standard potential of the reaction Ma–MaO_4^-. FLAGG, J. F., AND BLEIDNER, W. E. *J. Chem. Phys.*, **13**, 269–76 (*July*, 1945).—The element was obtained in an oxidized, anionic form by treatment with HNO_3 and H_2SO_4. It was deposited electrolytically on a Pt cathode, with reduction to the metal very probably the principal process. No anodic deposition was observed. The deposition potential for the metal from its anionic form is $-0{\cdot}146$ V *vs.* the normal hydrogen electrode in a solution of *p*H 2·36. This corresponds to a standard electrode potential of $-0{\cdot}41$ V for the process:

$$Ma + 4H_2O = MaO_4^- + 8H^+ + 7e.$$

The anionic form of the element is reduced and removed from solution by the metals Zn, Fe, Ni, Sn, Pb, Cu, Hg. HCl and $SnCl_2$ reduce the anion to a cation.

541.138.2 : 620.193.7 202

Hydrogen overvoltage as a factor in the corrosion of metallic couples. LEBROCQ, L. F., AND COCKS, H. C. *Nature, Lond.*, **156**, 536 (*Nov.* 3, 1945).

PHOTOCHEMISTRY 541.14

541.144 203

The mercury-photosensitized reactions of isobutane. DARWENT, B. DE B., AND WINKLER, C. A. *J. Phys. Chem.*, **49**, 150–64 (*March*, 1945).—Investigations o the Hg-photosensitized reactions of isobutane show that the products are almost entirely H, octanes, dodecanes and higher paraffin hydrocarbons, with only small amounts of CH_4 and hydrocarbons lighter than octane. The reaction rate and nature of the products are independent of the working pressure of the hydrocarbon at all temperatures investigated. The reaction temperature has little influence on the reaction rate but does affect the nature of the products; with increase of temperature the production of hexamethylethane increases while the production of dodecanes decreases. The material balance shows a loss of material at low temperatures; it improves with increasing temperature and is almost perfect at 250°C. The mechanism of the reactions is discussed in detail. N. M. B.

COLLOIDS . ADSORPTION 541.18

541.18 : 535.32 204

The determination of refractive indices of colloidal particles by means of a new mixture rule or from measurements of light scattering. HELLER, W. *Phys. Rev.*, **68**, 5–10 (*July* 1 *and* 15, 1945).—The rule gives better results for colloidal solutions than the rules of Newton, Lorenz–Lorentz, or Wiener if the difference between the refractive indices of the colloidal particles and of the medium is small. If it is large, but not $> 0{\cdot}7$, the refractive index of the particles can still be obtained to the 3rd or 4th place by using an empirical correction equation. If colloidal solutions are very opaque, the refractive index of the particles can be calculated from light scattering. Application of the respective equation requires that the refractive index of the medium and the particle size be known. The gravimetric and volumetric measurements in the determination of density of colloidal particles can be replaced by measurements of light scattering and refractivity.

541.18 : 537.363 = 4 205

Electrocataphoresis in semi-solid bodies. (Experimental studies.) KATZ, R. F. *J. Radiol. Electrol.*, **26** (*Nos.* 3–4), 59–61 (1944–1945).—Experiments have been carried out on the entry of ferric perchloride into gelatine by (1) simple diffusion, (2) cataphoresis, i.e. conduction by applied electrical current. It is

found that ions are actually introduced into tissue by the cataphoresis method of therapy but the depth reached is a few mms only. Ions so introduced accumulate in well-defined zones. The cellular constituents are also concentrated by displacement and this may actually be the origin of certain physiological effects, which become more complex as the tissues become more heterogenous. B. J. L.

541.18.04 : 612.11 206

A multiple coagulometer. STOKER, S. B. *J. Sci. Instrum.*, **22**, 146–8 (*Aug.*, 1945).

541.182 : 531.7 207

The cascade impactor: an instrument for sampling coarse aerosols. MAY, K. R. *J. Sci. Instrum.*, **22**, 187–95 (*Oct.*, 1945).—A new instrument is described which will sample windborne and stationary aerosols such as natural fogs and clouds, fine sprays, insecticidal mists, coarse dusts, pollen and spores, etc. By means of four progressively finer jets impinging on glass slides in series the sample is split up into size-graded fractions in a form suitable for microscopic analysis. The greatest efficiency of sampling is achieved for particles in the range 50 μ–1·5 μ diameter. Experimental results for the efficiency of jets in impacting particles are correlated by dimensional analysis, and a parameter of general applicability for estimating impaction efficiencies of jets is derived. Descriptions are given of new methods of dealing with volatile droplets and of analysing the samples.

541.182.02 : 539.26 *see Abstr.* 161

541.182.4 : 542.952 : 541.124 208

Phenomenological theory of emulsion polymerization. MONTROLL, E. W. *J. Chem. Phys.*, **13**, 337–48 (*Aug.*, 1945).—An aqueous emulsion of monomer is prepared using a soap as emulsifier. The addition of a catalyst starts the polymerization after an initiation period whose length depends on the mean radius of the monomer globules. As the reaction proceeds, the mean radius of the globules diminishes and the free soap conc. increases. It is believed that the initiation period is the result of the existence of an inhibitor in the monomer. The catalyst reacts with that part of the inhibitor which is dissolved in the water phase, so that in order for equilibrium to be restored some of the inhibitor must diffuse out of the monomer. Rate curves are derived on this basis using the added assumptions: (*a*) polymerization occurs at the monomer-water interface after the inhibitor conc. has reached a low threshold value. (*b*) Radius distribution function of monomer has a single max.

541.182.4 : 542.952 : 541.124 209

A general theory of the reaction loci in emulsion polymerization. HARKINS, W. D. *J. Chem. Phys.*, **13**, 381–2 (*Sept.*, 1945).

541.182.5 : 541.24 : 541.64 : 536.7 210

Deswelling of gels by high polymer solutions. BOYER, R. F. *J. Chem. Phys.*, **13**, 363–72 (*Sept.*, 1945).—When a cross-linked polymer initially swelled to its equilibrium volume in pure solvent is transferred to a solution of a high polymer in the same solvent and at the same temperature, the gel deswells. A quantitative treatment of this effect is given in terms of the Flory–Rehner theory of the thermodynamic properties of gels, and the Flory–Huggins theory of thermodynamics of high polymer solutions. The extent of deswelling depends on the mol. wt. and conc. of the solute, on the solvent-polymer interactions, and on the degree of cross-linking in the gel. It provides a new method for determining the number average mol. wt. of the solute. Calculations show the extent of deswelling under given conditions. Experimental data show determinations of mol. wts., using styrene-divinylbenzene copolymer gels and polystyrene solutions.

541.183 : 535.215.5 *see Abstr.* 53

541.183 : 541.135 : 545.84 211

Inorganic chromatography. I. Static adsorption measurements. II. Position, rate of advance and width of adsorbate zones. III. Elution curves. JACOBS, P. W. M., AND TOMPKINS, F. C. *Trans. Faraday Soc.*, **41**, 388–405 (*July*, 1945).—I. The adsorption of cations and anions from aqueous solutions of electrolytes by alumina was measured. The cation is more strongly adsorbed than the anion due to additional cation exchange adsorption. This is associated with the presence of sodium aluminate as an impurity, and is not due to hydrolytic adsorption, nor to an exchange involving either the Al^{+++} or H^{+} ion. The magnitude of the equivalent adsorption runs parallel with the covalent tendency of the adsorbate molecule. II. The relation of widths of bands of some cations on alumina columns, the rate of advance when developed with HCl, and the relative positions were studied and related to the results of Part I. The possible extension to quantitative estimations was examined, and various observations of Schwab were given alternative explanations. III. Differential and integral concentration distributions of Cu ions in solution have been obtained in a chromatographic study of the formation and development of bands on alumina columns. The variation of initial concentration and volume of $CuSO_4$ solutions, of length of column and *p*H of eluting solutions have been investigated and the results confirm and extend the conclusions of Parts I and II. Alumina is shown to be unsuitable as an adsorbent both from the view of separability of cations and of quantitative applications.

541.183 : 548.73 *see Abstr.* 284

541.183.022 : 541.124 *see Abstr.* 183

541.183.2 : [621.315.617.3 + 621.315.616.96] : 539.217.3 *see Abstr.* 157

541.183.26 212

The sorption of condensable vapours by porous solids. II. The validity of Gurwitsch's rule. BROAD, D. W., AND FOSTER, A. G. *J. Chem. Soc.*, **44**, 366–71 (*June*, 1945).—[See Abstr. 5318 (1932)]. Isothermals of the following liquids have been determined on SiO_2 gel at 25°C: acetic acid, acetone, di*iso*-propyl ether, dioxan, *n*-hexane, morpholine, *n*-octane, toluene and triethylamine. The amounts adsorbed at saturation decrease as the diameter of the adsorbed molecule increases. The observed relations can be explained by assuming that the adsorbent contains tapering capillaries. In these systems Gurwitsch's rule breaks

down and is seen to be a special case of a more general relation. The number of molecules held in the unimolecular layer also decreases as the molecular diameter increases.

541.183.26 213

An adsorption isotherm of radon. BURTT, B. P., AND KURBATOV, J. D. *Amer. Phys. Soc.* (*Proc., June*, 1945). *Abstr. in Phys. Rev.*, **68**, 101 (*Aug.* 1 *and* 15, 1945).—A procedure was developed for obtaining an adsorption isotherm of minute quantities of radon from an air-radon mixture at atmospheric pressure and $t = 25°$. Quantities of radon from $2{\cdot}0 \times 10^{-13}$ to $4{\cdot}4 \times 10^{-11}$ g were used. These were determined by means of an ionization chamber and electrometer calibrated against a radium standard. SiO_2 gel was used as adsorbent. The quantity of gel and the water contained were such that below $3{\cdot}6 \times 10^{-13}$ g of radon the adsorption isotherm followed Henry's law. At higher quantities the exponent of isotherm equation became <1 allowing, therefore, the determination in this region of unknown quantities of radon directly from the isotherm.

541.183.3 : 532.69 *see Abstr.* 39

541.183.4 214

The adsorption of water by proteins. PAULING, L. *J. Amer. Chem. Soc.*, **67**, 555–7 (*April*, 1945).

541.183.5 215

Rate-dependent chromatographic adsorption. WALTER, J. E. *J. Chem. Phys.*, **13**, 332–6 (*Aug.*, 1945).—The process is studied from the kinetic viewpoint, assuming a bimolecular reaction between adsorbent and solute. Boundaries characteristic of equilibrium adsorption are obtained only if the time of passage of the solution through the column is greater than the ½-life of the reaction by a factor of at least 100.

541.183.5 216

The adsorption of gelatin to silver bromide. SHEPPARD, S. E., LAMBERT, R. H., AND SWINEHART, D. *J. Chem. Phys.*, **13**, 372–7 (*Sept.*, 1945).—Experimental data illustrate a *specific case* of amphipathic adsorption, namely, of gelatin to AgBr. In this there is mutual coagulation of the Ag hydrosol and protein, followed by peptization in excess of dissolved protein. The phenomena in their relation to the isoelectric point of the protein and the *p*H of the solution are interpreted in terms of a basically duplex polar: nonpolar structure in proteins, and of a resonance factor, involving both adsorbent and adsorbate, in similar cases.

541.183.5 : 545.844 217

Chromatography of two solutes. OFFORD, A. C., AND WEISS, J. *Nature, Lond.*, **155**, 725–6 (*June* 16, 1945).—The theory of the chromatography of a single solute [Abstr. 2621 (1943)] is extended by an outline of the mathematical development for the case of two solutes. N. M. B.

541.183.5 : 545.844 218

Chromatography of two solutes. GLÜCKAUF, E. *Nature, Lond.*, **156**, 205–6 (*Aug.* 18, 1945). OFFORD, A. C., AND WEISS, J., GLÜCKAUF, E., *ibid.*, 570–1 (*Nov.* 10, 1945).—Correspondence relating to Abstr. 217 (1946)]. N. M. B.

541.183.55 219

The adsorption of some high molecular substances on active carbon. CLAESSON, I., AND CLAESSON, S. *Ark. Kemi Min. Geol.*, **19** A (*No.* 1), *Paper* 5, 12 *pp.* (1945).—It was found that the adsorption of C on some high-molecular substances, nitrocelluloses, synthetic rubbers and polyvinyl acetates increases with decreasing mol. wt. for the same class of substances. With 3 polyvinyl acetates, mol. wts. 22 000, 68 000 and 170 000 respectively, a more detailed investigation was carried out. Results showed that adsorption equilibrium is not obtained immediately, that a variation of the rate of adsorption occurs with the amount adsorbed, probably due to the differently active spots on the C, and that the amount adsorbed decreases with increasing mol. wt. An interpretation of the results in the terms of the Langmuir theory shows that this is not due to a decrease in the adsorption space available, but mainly to a decrease in adsorption affinity, with increasing mol. wt.

541.183.56 : 537.311.33 : 541.22 220

Deviations from stoichiometric proportions in cuprous iodide. MAURER, R. J. *J. Chem. Phys.*, **13**, 321–6 (*Aug.*, 1945).—The absorption of I by Cu_2I_2 was studied by means of a quartz microbalance. At 132·1°C the conc. of absorbed I $\propto \sqrt{\text{pressure}}$ of I vapour in equilibrium with the sample. The temp. dependence of the reaction at const. I v.p. indicates a heat of reaction of 0·24 eV per atom absorbed. The electrical conductivity of cuprous iodide at 132·1°C varies approx. as the 4/3 power of the conc. of the absorbed I.

541.183.57 221

Comparative isothermals of water and deuterium oxide on porous solids. BROAD, D. W., AND FOSTER, A. G. *J. Chem. Soc.*, 372–5 (*June*, 1945).—The adsorption isothermals of H_2O and D_2O were compared at 25° on SiO_2 and Fe_2O_3 gels and on charcoal. On each adsorbent the relative pressure-volume curves for the two liquids are identical. The results on the whole tend to support the capillary theory, although the behaviour of water on charcoal presents certain anomalies.

CHEMICAL STRUCTURE 541.2/.6

541.22 : 537.311.33 : 541.183.56 *see Abstr.* 220

541.24 : 541.64 : 532.739.2 222

The determination of molecular-weight distribution in high polymers by means of solubility limits. MOREY, D. R., AND TAMBLYN, J. W. *J. Appl. Phys.*, **16**, 419–24 (*July*, 1945).—By means of polymer fractions of known mol. wt., dissolved in solutions of known compositions, it is possible to determine the solubility law which relates the point of solution saturation to the mol. wt. and concentration of the dissolved polymer. Having established such a calibration, it is possible to determine the mol. wt. distribution in a heterogeneous sample of the polymer by suitable operation on a curve relating the mass of polymer precipitated to the amount of precipitant added to the solution. Optical means, making use of scattering from the precipitate, are used to obtain this latter curve. The method is applied to cellulose acetate

butyrate and is shown to give results in agreement with gravimetrically obtained distribution curves.

541.24 : 541.64 : 536.7 : 541.182.5 *see Abstr.* 210

541.25 : 536.655 : 536.751 223

The structure of liquid argon. LUND, L. H. *J. Chem. Phys.*, **13**, 317–20 (*Aug.*, 1945).—The method of Wall for calculating the free volume per atom in a liquid was applied to liquid A, using the atomic distribution curves at 84·3°K and at 91·8°K given by Eisenstein and Gingrich. From the free vols. at these temps., the entropy of the liquid at the boiling point is calculated to be 15·8 cal. degree^{-1} mole^{-1}. This value, with the calculated entropy, 32·2 cal. degree^{-1} mole^{-1}, of A vapour at the b.p., gives an entropy of vaporization of 16·4 cal. degree^{-1} mole^{-1}. The latent heat of vaporization is thus calculated to be 6·01 kJ/mole; as compared with the observed value of 6·3 kJ/mole. A comparison of theoretical and experimental atomic distribution curves at the temperatures 84·3°K and 91·8°K is given.

541.57 224

A simple classical model treatment of the chemical bond. COOK, M. A. *J. Chem. Phys.*, **13**, 262–8 (*July*, 1945).—A simple method for the determination of bond energies and internuclear distances is developed based on old quantum theory models modified to include the effect of zero-point vibrational energy and a type of resonance (orbital pulsations) assumed to be associated with nuclear vibrational motion. The virial theorem is employed in evaluating the proposed models. The method is applied to the hydrogen molecule and the "molecule ion" (H_2^+). Excellent agreement with experiment is achieved. A possible correlation of the old quantum theory and wave mechanics is indicated.

541.571 : 539.13 225

Energy of the Hg–C bond and the heat of atomization of carbon. SIDGWICK, N. V., AND SPRINGALL, H. D. *Nature, Lond.*, **156**, 599 (*Nov.* 17, 1945).—Of the two alternative values for the heat of atomization of carbon (124·3 or 170·6 kcal/gm atom) the use of the former gives such an unprecedentedly low value (4 kcal/gm atom) for the energy of the Hg–C bond as to afford strong evidence for the correctness of the latter. This gives a figure of 15·5, which, though low, is of the same order as P–P and As–As bonds.

541.62 226

The molecular state of acetic acid vapour. RITTER, H. L., AND SIMONS, J. H. *J. Amer. Chem. Soc.*, **67**, 757–62 (*May*, 1945).—Acetic acid was purified by fractional crystallization to give a product m.p. 16·56°C, and its liquid and vapour density measured over the range 25–158°C. The effective mol. wt. was determined from the vapour density over the range 50–800 mm pressure, and from saturation temp. to 170°C. In this range AcOH vapour contains at least one polymer of order higher than the dimer, and evidence favours the next highest polymer being the tetramer. The equilibrium constants, K_i, for the reactions $AcOH = (1/i)(AcOH)_i$ were calculated for $i = 2$ and 4, being given by $\log_e K_2 = (3\,645/T) - 11{\cdot}997$, $\log_e K_4 = (3\,390/T) - 13{\cdot}52$, for pressures in mm. The calculated heats of reaction are: $H_2 = -7\,250 \pm 200$ cal/mole, $H_4 = -6\,750 \pm 600$ cal/mole. W. R. A.

541.62 227

Investigation of the mechanism of butane isomerization using radioactive hydrogen as a tracer. POWELL, T. M., AND REID, E. B. *J. Amer. Chem. Soc.*, **67**, 1020–6 (*June*, 1945).—The exchange of tritium (T) between HT, TCl and butanes during isomerization catalysed by $AlCl_3$ was studied. The exchange of T in TCl to butane is large compared with T in HT to butane. The mechanism suggested for catalysed hydrocarbon isomerization is that a H atom is provided for entering the bonding sphere of a C atom (in the particular case studied this is done by $HAlCl_4$), thus displacing a Me or a H from its normal position, a process involving inversion, but at the same time keeping the Me group within the system catalyst-hydrocarbon, so that on the breaking up of this system the Me reattaches to the molecule in a position determined by the thermodynamic stability of possible isomers. W. R. A.

541.63 : 539.13 228

Electronic distribution and chemical reactivity in condensed unsaturated hydrocarbons. SVARTHOLM, N. *Ark. Kemi Min. Geol.*, **15 A** (*No.* 4), *Paper* 13, 13 *pp.* (1942).

541.63 : 539.13 229

The resonance structure of anthracene and phenanthrene. JONSSON, C. V. *Ark. Kemi Min. Geol.*, **15 A** (*No.* 4), *Paper* 14, 9 *pp.* (1942).

541.64 : 531.19 230

The degradation of high polymers. TUCKETT, R. F. *Trans. Faraday Soc.*, **41**, 351–9 (*July*, 1945).—Random degradation is treated as a problem in statistics which can be solved by the same technique as that for determining the partition of energy amongst a set of harmonic oscillators. The Darwin-Fowler method is used in which the various quantities required are expressed as coefficients in related power series: these are evaluated as contour integrals by the method of steepest descents. The size distribution functions for the degraded material are derived directly together with the various average mol. wts. by the use of differential operators. On this formulation, the extension to systems which are initially polydisperse is immediate and the method is then applied to a specific case of non-random degradation in which preferential splitting at the ends of the chains occurs. The kinetics of this type of degradation, which is found experimentally, are also discussed.

541.64 : 532.133 231

Viscosity-molecular weight relations for cellulose acetate butyrate. TAMBLYN, J. W., MOREY, D. R., AND WAGNER, R. H. *Industr. Engng Chem.*, **37**, 573–7 (*June*, 1945).—The relations between the mol. wts. of fairly homogeneous fractions of cellulose acetate butyrate and the viscosity function $\log_e \eta_r/c$ (determined in acetone and acetic acid) are given for the two cases: (*a*) the limiting value as $c \to 0$, known as

intrinsic viscosity; (*b*) the value at $c = 0{\cdot}25$ g per 100 m³. The establishment of a relation using the latter viscosity figure permits the determination of the viscosity-average mol. wt. without extrapolating to zero conc. Upon degrading samples of unfractionated cellulose acetate butyrate by heat, ball milling, and ultra-violet, it was found that the $\log_e \eta_r/c$ values and the number-average mol. wts. (from osmotic pressure) are also related by equations similar in form to those obtained on fractions.

541.64 : 532.739.2 : 541.24 *see Abstr.* 222

541.64 : 536.7 : 541.24 : 541.182.5 *see Abstr.* 210

541.67 : 535.343.32 232

The isoelectric nature of sulphanilamide and *p*-aminobenzoic acid. KLOTZ, I. M., AND GRUEN, D. M. *J. Amer. Chem. Soc.*, **67**, 843–6 (*May*, 1945).—Acidity constants for the hydrochlorides of sulphanilamide, N^1 : N^1-dimethylsulphanilamide, N^1 : N^1-diethylsulphanilamide, *p*-aminobenzoic acid, methyl *p*-aminobenzoate and ethyl *p*-aminobenzoate were determined from their ultraviolet spectra in solutions of different *p*H. The results give no indication of zwitterions in the isoelectric states of sulphanilamide and *p*-aminobenzoic acid. W. R. A.

541.67 : 539.133 233

Dipole moment and structure of organic compounds. XVII. The electric moments of—and—stilbene dibromide and of *p*-diacetylbenzene. WEISSBERGER, A. *J. Amer. Chem. Soc.*, **67**, 778–9 (*May*, 1945).—The electric moments of the stilbene dibromides and of *p*-diacetylbenzene were determined and discussed. The values for the dibromides indicate that the α-stilbene dibromide is the *meso*-compound and β-stilbene dibromide the *dl*-compound. The value for *p*-diacetylbenzene is 15% lower than the value calculated for diacetyl, possibly because of resonance effects. W. R. A.

541.68 234

Molecular structure and mechanical properties of high polymers—a review. MARK, H. *Amer. J. Phys.*, **13**, 207–14 (*Aug.*, 1945).

541.68 : 678.7 235

Determination of unsaturation in butyl rubber. REHNER, J., JR., AND GRAY, P. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 367–70 (*June*, 1945).—A procedure is described for determining the unsaturation in Butyl rubber. It is based on the reaction of the polymer, in solution, with O_3 to give degraded species, the limiting viscosity of which is governed by the original unsaturation. Information is given on the effects of conc. and mol. wt. on the viscosity of the polymer solution, the stability of the ozonized solution and the effects of certain addition agents. Unsaturation values based on this method and on one involving reaction with iodine chloride are correlated for Butyl rubbers containing diolefine units.

541.68 : [678.77 + 679.5] 236

Synthetic rubbers and plastics—mechanical properties in relation to molecular structure. POLLETT, W. F. O. *Distrib. Elect.*, **18**, 48–51 (*Oct.*, 1945).—[Abstr. 211 B (1946)].

541.8 : 532.71 : 539.217 237

The physical chemistry of membranes with particular reference to the electrical behaviour of membranes of porous character. I. The nature of physiochemical membranes—membranes as physiochemical machines; preparation and properties of membranes of highly pronounced electrical properties. SOLLNER, K. *J. Phys. Chem.*, **49**, 47–67 (*March*, 1945).—An attempt to circumscribe the meaning of the term "membrane" leads to a comprehensive definition for physiochemical membranes. The characteristic electrochemical properties of collodion membranes are shown to be due to the presence of anionic (i.e. acidic) impurities (oxynitrocellulose, "nitrocellulosic acid") in the collodion. Known methods of electrochemical activation of collodion and collodion membranes are reviewed and new improvements of technique are described. Dried-type collodion membranes may now be prepared which combine extreme ionic selectivity with great permeability for the unrestricted ion. The absolute permeability of such "megapermselective" membranes is 3 to 4 orders of magnitude > that of any known membranes of high ionic selectivity. The method of preparation of electropositive membranes by the adsorption of protamine on highly porous collodion membranes is improved, and the preparation of electropositive "megapermselective" protamine collodion membranes is described. N. M. B.

542.23 : 545.37 238

Macro- and microvessels for polarographic analysis. LANGER, A. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 454–6 (*July*, 1945).—An external calomel electrode as well as an internal Hg pool can be used as the non-polarizable anode. Both vessels are suited for titration work.

542.231.8 239

High-speed agitator for pressure vessels. KIEBLER, M. W. *Industr. Engng Chem.*, **37**, 538–40 (*June*, 1945).

542.47 240

Vacuum drying apparatus for unstable polymeric materials. KEMP, A. R., AND STRAITIFF, W. G. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 387–9 (*June*, 1945).

542.48 : 541.123.21 *see Abstr.* 177

542.71 241

Ozonizer capable of producing a constant amount of ozone. GREENWOOD, F. L. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 446–7 (*July*, 1945).—By maintaining a constant transformer primary voltage and a constant O_2 flow, and by cooling the water in the Berthelot tubes, the conventional laboratory ozonizer can be designed to maintain O_3 production const. to 0·1% O_3 (by volume) over a period of 12 hrs. or longer.

542.77 : 621.691.3.02 242

An automatic gas circulating pump. SIMONS, J. H.,

BRICE, T. J., AND PEARLSON, W. H. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 404 (*June*, 1945).

542.921.9 : 539.169 243

Radiochemical changes in some fatty acids. HONIG, R. E. *Amer. Phys. Soc.* (*Proc.*, *Oct.*, 1945). *Phys. Rev.*, **68**, 235 (*Nov.* 1 *and* 15, 1945).

542.952 : 541.124 : 541.182.4 *see Abstr.* 208, 209

542.952 : 541.127 244

Polymerization of styrene under various experimental conditions. ABERE, J., GOLDFINGER, G., NAIDUS, H., AND MARK, H. *J. Phys. Chem.*, **49**, 211–26 (*May*, 1945).—Polymerization of styrene was carried out in various solvents (particularly PhMe, CH_3OH, CCl_4) with various amounts of benzoyl peroxide as catalyst at 60° and 100°c in various concs. of the monomer. Polymerization in methanol showed certain irregularities, presumably due to the formation of a gelatinous phase during polymerization. The initial overall rate increased with monomer concentration somewhat faster than simple proportionality required. A method is indicated to show how intrinsic viscosities of the polystyrene samples obtained can be used to estimate the number average polymerization degree. Its initial value can be expressed in terms of three rate constants: rate of propagation, termination and chain transfer. The influence of the solvent on the last of these is discussed.

542.952.6/.7 : 541.127 *see Abstr.* 189

CHEMICAL ANALYSIS 543/545

545.3 = 4 245

Electro-analysis apparatus and a study of the electrolytic current. LASSIEUR, A. *Rev. Gén. Élect.*, **48**, 280–4 (*Nov.*, 1940).

545.31 : 621.357.7 246

Electrolytic determination of copper and zinc. MICELI, A. S., AND MOSHER, R. E. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 377–8 (*June*, 1945).

545.32 247

Automatic apparatus for electrolysis at control potential. LINGANE, J. J. *Industr. Engng Chem. Analyt. Edit.*), **17**, 332–3 (*May*, 1945).—An apparatus is described which automatically maintains the potential of an electrode constant during electrolytic determinations and separations. The instrument is sensitive to $\pm 0{\cdot}02$ V, is applicable with currents and applied voltages of any magnitude, and does not require preliminary calibration.

545.37 248

A polarographic study of barium ion removal by complex phosphates. CAMPBELL, J. A., AND SCHENKER, F. *J. Amer. Chem. Soc.*, **67**, 767–9 (*May*, 1945).—The effect of various complex phosphates on the Ba ion was investigated polarographically. $(NaPO_3)_6$ forms a compound of the composition $Ba_3(PO_3)_6$, which dissolves in excess $(NaPO_3)_6$, probably forming $Na_2(Ba_2P_6O_{18})$. $Na_4P_2O_7$ precipitates $Ba_2P_2O_7$. The results indicate the existence in solution of a compound $Na_5P_3O_{10}$ which reacts with Ba to form insoluble $Ba_5(P_3O_{10})_2$ and probably soluble $Na_3(BaP_3O_{10})$. The slow cooling of a melt corresponding to the composition $Na_6P_4O_{13}$ results in a mixture of $NaPO_3$ and $Na_5P_3O_{10}$. W. R. A.

545.37 249

Polarographic behaviour of chloro and bromo complexes of stannic tin. LINGANE, J. J. *J. Amer. Chem. Soc.*, **67**, 919–22 (*June*, 1945).—In the presence of a very large concentration of Cl′ ion, Sn^{IV} gives a well-developed doublet wave, the first part corresponding to the reduction of $SnCl_6''$ to $SnCl_4''$ ions, and the second to reduction of $SnCl_4''$ to the metal. In a supporting electrolyte composed of 4M NH_4Cl, 1N HCl and 0·005% gelatin, the ½-wave potentials of the doublet wave are 0·25 and 0·52 V, *vs.* the saturated Hg_2Cl_2 electrode, and the diffusion current constant is 6·55 at 25°c. The first wave should be suitable for the determination of small amounts of Sn in the presence of large amounts of Cd or Zn, and the second wave may permit determination of Sn in presence of equal or smaller amounts of Pb. Sn produces a well-defined double wave in 4M NH_4Br as supporting electrolyte, and the first wave should be suitable for the determination of small amounts of Sn in presence of large amounts of Pb. W. R. A.

545.37 250

Polarographic determination of iron and zinc in phosphate coatings. KNANISHU, J., AND RICE, T. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, *444–6* (*July*, 1945).—A polarographic method for the simultaneous determinations of Fe and Zn in commercial phosphate coatings was developed. The analyses are conducted in a supporting electrolyte containing 0·3 molar NH_4 oxalate. Analysis can be completed in <1 hr.

545.37 251

Potentiometric titration of small amounts of boron. A null point method. RUEHLE, A. E., AND SHOCK, D. A. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 453–4 (*July*, 1945).—A rapid direct-titration method for determining B in low concs. is described, which was applied to $MgCl_2$ solutions and other samples.

545.37 : 541.135.6 252

Some factors affecting the precision in polarographic analysis. BUCKLEY, F., AND TAYLOR, J. K. *Trans. Electrochem. Soc.*, **87** (*Prepr.* 17), 16 *pp.* (1945).—The factors influencing the variables of the Ilkovič equation are analysed. Tolerances in the control of the experimental conditions are estimated which permit chemical analyses or determinations of diffusion-current constants with a precision of ±2%. The presence of maxima in polarographic waves and the effect of their suppression on the diffusion current are discussed. Criteria are given for determining when the current is represented by the Ilkovič equation.

545.37 : 542.23 *see Abstr.* 238

545.721/.723 : 669.017.9 253

The application of the vacuum-fusion method to the determination of the oxygen, hydrogen and nitrogen contents of non-ferrous metals, alloys and powders. SLOMAN, H. A. *J. Inst. Met.*, **71**, 391–414 (*July*,

1945).—An investigation is described of the vacuum-fusion method, developed originally for determining O_2, H_2 and N_2 in steel, for similar determinations in non-ferrous metals and alloys. The modifications required in procedure were examined for different metals; attention was given to the determination of the gas contents of Al and Al-base alloys, and the usefulness of the method in correlating gas content with density, porosity, etc., is indicated. The method is of considerable importance in powder metallurgy.

N. M. B.

545.81 254

Application of colorimetry to analysis of corrosion-resistant steels. Determination of boron. Weinberg, S., Proctor, K. L., and Milner, O. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 419–22 (*July*, 1945).—A rapid procedure for the determination of small amounts of B from 0·001–0·005% in corrosion-resistant steels is suggested. The bulk of the elements present are removed from B by adding NaOH. The use of quinalizarin as the colour reagent is subject to few interferences—As and Ge, the amount of which must be several hundredfold that of B to cause noticeable interference. The method is satisfactory for use in highly coloured solutions where the B cannot be determined directly. A spectrophotometric study is included. Estimation may be by photometric measurement or by visual comparison against permanent standards.

545.81 255

Colorimetric determination of copper in aluminum alloys. Patridge, R. F. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 422–4 (*July*, 1945).—A rapid, colorimetric method for the determination of Cu in Al alloys containing up to 8% Cu is described. In routine determinations the method is accurate to within ±0·03% Cu, and can be applied to all commercial Al alloys, including those of high Si content. The results agree with analyses obtained electrolytically.

545.81 256

Colorimetric determination of potassium. Adams, M. F., and St. John, J. L. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 435–6 (*July*, 1945).—The photometric determination of K as chloroplatinate is reliable and convenient. A precision of 2% can be attained with samples containing >0·2 mg of K. The iodoplatinate method is about 100 × more sensitive, but slow changes of colour were observed.

545.81 257

Colorimetric method for determination of DDT. Bailes, E. L., and Payne, M. G. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 438–40 (*July*, 1945).

545.81 258

Determination of bismuth in blood serum or plasma. Giacomino, N. J. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 456–8 (*July*, 1945).—A method is presented for colorimetric estimation of small quantities of Bi in blood serum or plasma; it can determine from 10–100 μg per 100 cm^3 of serum. When these amounts of Bi are added to serum and plasma, the average recovery is 92 ± 6%, the error tending to be less as the amount of Bi increases. Improvements are: the use of ascorbic acid as a reducing and stabilizing reagent, the attainment of maximum light absorption, and the reduction to a minimum of the colour intensity of the reagent blank.

545.823 259

Spectrographic analysis of magnesium alloys. Averbach, B. L. *Industr. Engng Chem.* (*Analyt. Edit.*), **17**, 341–8 (*June*, 1945).—A Mg-base alloy containing 6% Al, 3% Zn and 0·20% Mn was analysed. A statistical analysis of the procedure indicated that an accuracy of at least ±5% of the contained element was attainable. Methods of casting a representative sample free from micro-shrinkage were investigated.

545.823 : 535.343.32 260

Ultra-violet absorption method for the determination of polyunsaturated constituents in fatty materials. Brice, B. A., and Swain, M. L. *J. Opt. Soc. Amer.*, **35**, 532–44 (*Aug.*, 1945).—A method is described for the simultaneous spectrophotometric determination of non-conjugated and conjugated diene, triene and tetraene fatty acid constituents in vegetable oils, animal fats, their soaps and purified fatty acid preparations. The method involves measurement of the ultra-violet absorption of a sample before and after isomerization. Correction of the data for absorption by extraneous compounds and use of alkaline glycerol as an isomerization medium result in greater sensitivity and accuracy in the analysis for minor and trace proportions of these polyunsaturated constituents.

545.828: 535.331 261

The effect of extraneous elements on spectral line intensity in the cathode-layer arc. Scott, R. O. *J. Soc. Chem. Ind.*, **64**, 189–94 (*July*, 1945).—Data are given for the spectral line intensities of various trace elements in the cathode-layer arc when they are incorporated into different bases. The bases considered are Al_2O_3, SiO_2, $CaCO_3$, $Ca_3(PO_4)_2$, $Na_4P_2O_7$, NaCl, Na_2CO_3. The effects on the actual line intensities and on the ratios of the line intensities to those of Fe as internal standard are considered. Most trace constituents gave their highest line intensities in the Al_2O_3 base, whilst the more volatile trace constituents like Cu, Ag, Zn, Bi and Cd tended to be greatly depressed by NaCl. Cr, V and Mo were enhanced by Ca salts and depressed by SiO_2. Constant intensity ratios for Co and Ni to Fe were obtained in all bases except SiO_2.

545.84 262

A new method for adsorption analysis of solutions. Tiselius, A. *Ark. Kemi Min. Geol.*, **14 B** (*No.* 4), *Paper* 22, 5 *pp.* (1941).

545.84 263

Adsorption analysis of some triglycerides and fatty acids. Claesson, S. *Ark. Kemi Min. Geol.*, **15 A** (*No.* 3), *Paper* 9, 9 *pp.* (1942).

545.84 : 541.135 : 541.183 *see Abstr.* 211

545.844 : 541.183.5 *see Abstr.* 217, 218

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548.0 : 669.018 264

Striated structure of age-hardened alloys. GUINIER, A., AND JACQUET, P. *Nature, Lond.*, **155**, 695 (*June* 9, 1945).

548.0 : 669.018 265

Striated structure of age-hardened alloys. GAYLER, M. L. V. *Nature, Lond.*, **156**, 333 (*Sept.* 15, 1945).—[See Abstr. 264 (1946)].

548.1 : 549.514.51 266

Physical axes of reference and geometrical axes of reference for quartz. ROGERS, A. F. *Amer. J. Sci.*, **243**, 384–92 (*July*, 1945).—Co-ordinate axes OX, OY and OZ used in equations involving piezo-electric, elastic, and other physical properties of crystals may be called *physical axes of reference*. These are orthogonal axes for hexagonal crystals as well as for crystals of the other crystal systems. Co-ordinate axes of reference for designating crystal faces may be distinguished as *geometrical axes of reference*.

548.54 267

Habit modification of ammonium dihydrogen phosphate crystals during growth from solution. KOLB, H. J., AND COMER, J. J. *J. Amer. Chem. Soc.*, **67**, 894–7 (*June*, 1945).—The habit modification of $NH_4H_2PO_4$ crystals by various metal ions was investigated. The results are explained by adsorption of metal ions on the crystal surface, and measurements of the reticular densities of the $NH_4H_2PO_4$ crystal planes are in agreement with the adsorption theory. It is suggested that the degree of tapering may be correlated with the solubility product of the metal hydroxides. The habit modification of the $NH_4H_2PO_4$ crystal over the range of concentration 0 to 5×10^{-3} mols/l of Al, chromic and stannic ions were measured.

W. R. A.

548.7 : 539.164.9 268

Effect of alpha-ray bombardment on glide in metal single crystals. ANDRADE, E. N. DA C. *Nature, Lond.*, **156**, 113–4 (*July* 28, 1945).—Stressed single-crystal wires of Cd were bombarded with α-rays from a strong polonium source, deposited on the inside of a nickel cylinder 1 cm long, split longitudinally so that it could be made to surround the wire. It was thought that the intense temperature agitation produced by the impact of a particle would, when the particle struck the metal in the immediate neighbourhood of a minute surface crack or dislocation, initiate glide. The α-particles, which penetrated about 0·005 mm into the metal, caused considerable local disturbance, but under the experimental conditions did not produce appreciable bulk heating. Direct experiment proved that the rise of temperature at the axis of the wire did not exceed 0·01°C. The preliminary results of the experiments showed that when a wire is stressed so as to produce a slow creep, of the order of 0·05% per minute, bombardment with α-particles causes the rate of flow to increase to several times the value which obtained before the bombardment, although the wire was bombarded over only one-third of its length.

548.7 : 539.2 *see Abstr.* 152

548.73 269

X-ray studies on potassium antimonates. SPIEGELBERG, P. *Ark. Kemi Min. Geol.*, **14 A** (*No.* 2), *Paper* 5, 12 *pp.* (1940).

548.73 270

The crystal structure of potassium hydroxostannate and some related compounds. BJÖRLING, C. O. *Ark. Kemi Min. Geol.*, **15 B** (*No.* 1), *Paper* 2, 6 *pp.* (1941).

548.73 271

The crystal structure of lead metantimonate and isomorphous compounds. MAGNÉLI, A. *Ark. Kemi Min. Geol.*, **15 B** (*No.* 1), *Paper* 3, 6 *pp.* (1941).

548.73 272

The crystal structure of zinc metantimonate and similar compounds. BYSTRÖM, A., HÖK, B., AND MASON, B. *Ark. Kemi Min. Geol.*, **15 B** (*No.* 1), *Paper* 4, 8 *pp.* (1941).

548.73 273

X-ray analysis of potassium perchromate K_3CrO_8 and isomorphous compounds. WILSON, I. A. *Ark. Kemi Min. Geol.*, **15 B** (*No.* 1), *Paper* 5, 7 *pp.* (1941).

548.73 274

An X-ray study of monetites and some related compounds. BENGTSSON, E. *Ark. Kemi Min. Geol.*, **15 B** (*No.* 1), *Paper* 7, 8 *pp.* (1941).

548.73 275

The crystal structure of cordierite. BYSTRÖM, A. *Ark. Kemi Min. Geol.*, **15 B** (*No.* 3), *Paper* 12, 7 *pp.* (1942).

548.73 276

The unit cell and space group of potassium tetrachlorozincate. KLUG, H. P., AND SEARS, G. W., JR. *J. Amer. Chem. Soc.*, **67**, 878 (*May*, 1945).—X-ray investigation of K_2ZnCl_4 yielded values $a_0 = 26{\cdot}70$ Å, $b_0 = 12{\cdot}26$ Å and $c_0 = 7{\cdot}28$ Å for the unit cell, with $12K_2ZnCl_4$ per cell. The space group is $C_{2v}^4 - Pma^5$.

W. R. A.

548.73 277

Two new modifications of the Fourier method of X-ray structure analysis. BOOTH, A. D. *Trans. Faraday Soc.*, **41**, 434–8 (*July*, 1945).—The first modification is a generalization of the projection in which, instead of projecting the whole contents of a unit all upon a basal plane, only that part contained between specified planes is included. The second is a modification of the normal method of Fourier sections in which, instead of the usual single atom per synthesis, a number of atoms can, under suitable conditions, be obtained on the same section. The treatment for the general case is given and then that for the particular monoclinic space group P_{2_1}/c in order to show the practical application.

548.73 278

Correction of X-ray diffraction intensities for Lorentz and polarization factors. BUERGER, M. J., AND KLEIN,

G. E. *J. Appl. Phys.*, **16**, 408–18 (*July*, 1945).—In crystal structure determination, it is necessary to apply corrections for Lorentz and polarization factors to the intensities of the X-ray diffraction spectra. Lorentz factors can all be reduced to the form, $L = (1/S) \cdot (1/\sin \Upsilon)$, where S is a scale factor, constant for a particular recorded level of the reciprocal lattice, but differing in form depending on the method of recording. The factor can be eliminated from subsequent computation of corrections by proper timing of the photographs of the levels of the reciprocal lattice, and then all photographs have the same simple Lorentz correction, $\sin \Upsilon$. The polarization factor depends only on the reciprocal lattice co-ordinate, σ, and is independent of method of recording. Six tables are provided for simplifying the routine computation of Lorentz and polarization corrections, and the methods advocated for correction are illustrated by examples.

548.73 279

Accuracy of atomic co-ordinates derived from Fourier synthesis. Booth, A. D. *Nature, Lond.*, **156**, 51–2 (*July* 14, 1945).

548.73 280

Crystal structure of barium titanate. Forrester, W. F., and Hinde, R. M. *Nature, Lond.*, **156**, 177 (*Aug.* 11, 1945).—See Abstr. 2566 (1945)].

548.73 : 535.42 281

X-ray analysis with the aid of the "fly's eye." Bragg, L., and Stokes, A. R. *Nature, Lond.*, **156**, 332–3 (*Sept.* 15, 1945).

548.73 : 537.531 : 535.43 282

Imperfections of crystal lattices as investigated by the study of X-ray diffuse scattering. Guinier, A. J. *Proc. Phys. Soc., Lond.*, **57**, 310–24 (*July*, 1945).—A perfect crystal diffracts X-rays only in discrete directions, given by the Bragg–Laue laws. All scattering observed in directions other than these, except Compton scattering, is due to imperfections of the crystal. The experimental method of obtaining useful scattering patterns, and the principles of the calculation of actual structure from the distribution of anomalous scattering, are described. Examples of application of this method to the study of thermal atomic movements, lattice deformations under mechanical stresses, defects of periodicity in diamond and in fibrous crystals, space-arrangement of atoms in solid solutions (order-disorder transformation, age-hardening) and scattering by small particles are outlined.

548.73 : 539.23 283

On the structure of multilayers and the relation between optical and mechanical thickness and X-ray spacing. Stenhagen, E. *Ark. Kemi Min. Geol.*, **14 A** (*No.* 3), *Paper* 11, 12 *pp.* (1941).—The structure of the Langmuir–Blodgett built-up films is discussed and it is emphasized that no agreement can be expected between the optical and the long X-ray spacing. The optical spacing per layer is a measure of the amount of material transferred from the liquid to the solid surface, and varies with the deposition ratio and the piston pressure used. After a short initial soap bubble stage, an oriented crystallization takes place within the multilayer and the long X-ray spacing obtained is that characteristic for a crystalline modification of the substance forming the multilayer, and is independent of the mode of deposition. In spite of this crystallization the optical thickness per layer may remain the same. Very solid multilayers are optically clear for long periods of time as the growth of the crystallites to sizes comparable with the wavelength of visible light takes place extremely slowly at room temperature. Some apparent misinterpretations in the literature are shown. The use of mixed multilayers for the study of molecular migration and rearrangement in multilayers is suggested.

548.73 : 541.183 284

An investigation on the formation of surface layers. D'Eustachio, D., and Brody, S. B. *J. Opt. Soc. Amer.*, **35**, 544–51 (*Aug.*, 1945).—When a series of back reflection X-ray powder pictures of a freshly crushed coarse crystalline powder is taken, successive pictures exhibit a progressive change. Individual spots sharpen, diffuse portions of powder rings disappear, and the number of spots increases markedly with time. The increase in spots is not caused by breaking up of the particles. An account of the technique used for observing the effect is given. Experiments are described which indicate that the changes are definitely associated with the surface. The time rate of change increases with the hardness of the material and appears to be related to the degree of valance binding in the structure. A tentative explanation of the phenomenon is proposed which can account for all the observed effects.

548.73 : 549.211 285

Crystal structure of diamond. Ramachandran, G. N. *Nature, Lond.*, **156**, 83 (*July* 21, 1945).—[See Abstr. 2571 (1945)].

549.211 : 548.73 *see Abstr.* 285

549.514.51 : 548.1 *see Abstr.* 266

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550.36 : 551.1 286

Thermal history of the earth. Bullard, E. C. *Nature, Lond.*, **156**, 35–6 (*July* 14, 1945).—Large variations in the rate of increase of temperature with depth below the earth's surface are attributed mainly to varying thermal conductivities of the rocks. The mean heat flows (temperature gradient × conductivity) are much more nearly const. Part of the remaining differences are due to distortion of the heat-flow lines by such formations as salt-domes. About 80% of the flow originates in radioactivity, which is sufficient in 10–20 km of granite to produce the observed effect. The central core must therefore be free from radioactive substances, otherwise the heat produced would be carried upwards by convection to the surface. The lack of granite under the main oceans will cause lower temperatures and higher densities there, and convection currents thus produced

may explain widespread fields of gravity anomalies. Seismological results suggest that melting will not normally occur in the outer 30–40 km crust. Theoretical estimates suggest a temperature of 3 000°C at 600 km, 10 000°C at the outer edge of the molten metallic core, and little more than this at the centre.

A. HU.

550.361 : 551.21 287

Conjectures regarding volcanic heat. GRATON, L. C. *Amer. J. Sci.*, **243 A**, 135–259 (1945). *Daly Vol.*—By applying physical and thermodynamic principles and data to a simplified concept of the volcano and its processes, an attempt is made to visualize what takes place from source to surface in an active conduit, keeping in view the dynamic nature of the system. Granted a supply of molten granite with 9·4% dissolved volatiles at a depth of 40 km and 1 200°C, it is possible to "sample" this ascending magma system all the way to the surface, and derive to a first approximation quantitative values for pressure, temp., gas-melt ratio, volume and velocity of the system, and distribution of the heat between melt and gas, as all these factors change in passing the various depths. The calculated declines in temperature are decidedly larger than is often supposed. Apart from conduction to the conduit walls and the heavy losses at the surface by radiation and air convection, cooling may reach 350–500° by exsolution and expansion of the gas and the kinetic drains of accelerating expulsion and explosive comminution of the magma. Viscosity, an extremely important property of the system, especially because of the near-surface cooling, is examined in its capacity to retard equilibrium and thus lead eventually to violent explosive eruption.

550.362 : 536.21 288

An estimate of the surface flow of heat in the West Texas Permian Basin. BIRCH, F., AND CLARK, H. *Amer. J. Sci.*, **243 A**, 69–74 (1945). *Daly Vol.*—Laboratory measurements of the effect of compression and of wetting on the thermal conductivity of a set of samples from wells in the West Texas Permian Basin are combined with Hawtof's measurements of temp. in the Big Lake No. 1–B well to obtain estimates of the flow of heat to the surface in this region. The average value so found, $2{\cdot}0 \times 10^{-6}$ calories per cm^2 per sec., is higher than the figures published for England and South Africa.

550.381 289

Calculation of vertical component (*Z*) for potential fields from observed values of declination (*D*) and horizontal intensity (*H*). DAVIDS, N. *Terr. Magn. Atmos. Elect.*, **49**, 239–42 (*Dec.*, 1944).—An integral transformation formula is given for calculating the poorly observed *Z* from *D* and *H*, the assumption being that the whole field originates from sources inside the earth. A trial computation for a point in mid-Pacific using the *D* and *H* values for an eccentric-dipole field gives a result correct within the errors of chart-reading and computation. External fields can be estimated by computing *Z* by this procedure at points where it is well known; any discrepancy is then due to the external field. The method can be applied to testing *Z*-charts for consistency with the corresponding *D*- and *H*-charts.

A. HU.

550.384 : 523.746 290

Solar and magnetic data, January to March, 1945, Mount Wilson Observatory. NICHOLSON, S. B., AND MULDERS, E. S. *Terr. Magn. Atmos. Elect.*, **50**, 140–1 (*June*, 1945).

550.385 291

Principal magnetic storms, January to March, 1945. *Terr. Magn. Atmos. Elect.*, **50**, 153–9 (*June*, 1945).

550.386 : 551.594.5 292

The geographic incidence of aurora and magnetic disturbance, southern hemisphere. VESTINE, E. H., AND SNYDER, E. J. *Terr. Magn. Atmos. Elect.*, **50**, 105–24 (*June*, 1945).—Average features of geomagnetic disturbance and aurora in south polar regions are compared with those derived on the basis of more extensive data for high northern latitudes. The seasonal and yearly average of the disturbance of daily variation (S_D) is obtained for various stations in Antarctic regions and its variation in amplitude with latitude compared with that for the northern hemisphere. These data are used to estimate the position of the southern zone of maximum auroral frequency and this result compared with available yearly frequencies of aurora.

550.389 293

American magnetic character-figure, C_A, three-hour-range indices, *K*, and mean *K*-indices, K_A, for January to March, 1945. JOHNSTON, H. F. *Terr. Magn. Atmos. Elect.*, **50**, 131–4 (*June*, 1945).

550.389 294

Note on magnetic character-figures *C* for 1943. SWOBODA, G. *Terr. Magn. Atmos. Elect.*, **50**, 151–2 (*June*, 1945).

550.389 295

Five international quiet and disturbed days for October and December, 1944. JOHNSTON, H. F. *Terr. Magn. Atmos. Elect.*, **50**, 152 (*June*, 1945).

550.389 296

A survey of methods of constructing magnetic charts. BERNSTEIN, A. *Terr. Magn. Atmos. Elect.*, **49**, 169–80 (*Sept.*, 1944).—A historical survey is made of the analytical and graphical methods of locating isomagnetic lines on world charts by interpolation from station observations. Suggestions are made for improving presentation so as to remove the present inconsistencies.

A. HU.

550.4 : 539.16.08 297

Measurement of soil-air ions over the Fort Collins anticline. TRIPP, R. M. *Geophysics*, **10**, 238–47 (*April*, 1945).—The soil solution is examined for compounds of very low solubility product which might exist in a state of saturation over a large area; some radioactive compounds are found to fill this requirement better than any others. It is postulated that these minerals are preferentially precipitated in the interstices of the near surface soil by the evaporation of the soil water caused by the passage of gaseous

hydrocarbons escaping from their subsurface reservoir. Measurements of the rate of formation of ions in the soil air over a producing structure are presented.

550.83 : 553.982 298

Geophysical methods applied to oil prospecting. BRUCKSHAW, J. McG. *J. Inst. Petrol.*, **30,** 271–310 (*Oct.*, 1944).—The principles, limitations and achievements of the seismic, gravitational, electrical and magnetic methods of geophysical survey are reviewed. All methods require the measurement of a physical property which differs as between the mineral sought and the surrounding rocks; those capable of detection at the surface are, respectively, density and elasticity; density; resistivity; and susceptibility. In the case of oil prospecting the structure sought is usually one associated with oil-bearing formations, since the oil-rich minerals themselves have no outstanding physical characteristics. The particular formations best detected by the various methods are contrasted.

A. HU.

550.831 : 550.838 299

Gravity and magnetic investigations at the Grand Saline Salt Dome, Van Zandt Co., Texas. PETERS, J. W., AND DUGAN, A. F. *Geophysics*, **10,** 376–93 (*July*, 1945).—Detailed gravity and magnetic surveys were made at the Grand Saline Salt Dome. The results of the surface gravity and magnetic surveys, and the subsurface gravity survey in the Morton Salt Mine are illustrated and discussed.

550.834 300

The interpretation of well shot data. II. DIX, C. H. *Geophysics*, **10,** 160–70 (*April*, 1945).—Five methods of shooting a well for the determination of vertical velocity, and the methods of reduction of the data, are discussed. Means are described for determining the existence of interference due to transmission of vibration down the cable which suspends the well geophone.

550.834 301

The computation of output disturbances from amplifiers for true wavelet inputs. RICKER, N. *Geophysics*, **10,** 207–20 (*April*, 1945).—A procedure for the computation of output forms for a true wavelet input is outlined taking account of amplifier distortions. Examples are given showing the manner in which the output forms may be determined from the known amplitude, frequency and phase-frequency characteristic curves of the amplifiers.

550.834.5 302

The analysis of oblique reflection data. HORTON, C. W. *Geophysics*, **10,** 186–206 (*April*, 1945).—In regions where the reflecting layers have large dips it is difficult to interpret reflection data if the shot-point and the instrument-spread do not coincide. Rigorous methods of locating the reflection-point and of determining the magnitude and direction of the dip are given. Two approximate solutions are discussed in detail and by means of theoretical considerations and numerical examples it is shown that the errors introduced by the approximations are small.

550.837 303

The principle of variation in path with an application to structural mapping. EVJEN, H. M. *Geophysics*, **10,** 221–8 (*April*, 1945).—A general functional analysis of the low frequency electric exploration problem is presented. The theory is applied to some field data where a fair degree of subsurface control exists.

550.838 304

The magnetic field over igneous pipes. BLUM, V. J. *Geophysics*, **10,** 368–75 (*July*, 1945).—A magnetic survey of the Canon City, Colorado, area is summarized. The results of magnetic traverses are given over exposed igneous pipes containing an appreciable amount of magnetite. These traverses reveal a magnetic min. near the geometric centre of the tops of the pipes. Away from the centre the field increases in intensity and reaches its max. strength along the southern edge of the intrusion. Small igneous pipes at or near the surface cause radical changes in the magnetic field within very short distances.

550.838 : 550.831 *see Abstr.* 299

551.1 : 550.36 *see Abstr.* 286

551.12 : 523.12 *see Abstr.* 14

551.21 : 550.361 *see Abstr.* 287

551.464 305

Variations in the composition of the sea in West African waters. HOWAT, G. R. *Nature, Lond.*, **155,** 415–17 (*April* 7, 1945).—Samples of sea-water from 8 fathoms at a point 1·5 m off Accra were taken weekly from June, 1943, to Sept., 1944, and examined for temperature, salinity, dissolved oxygen, phosphate, and vegetative and animal plankton. The results are shown graphically and interpreted in terms of rainfall and surface currents. An influx of cold ocean water along the Gold Coast during July–Sept., more saline and richer in phosphates, is probably of economic importance in the main fishing season. A. HU.

METEOROLOGY 551.5

551.506.8 306

Report on the phenological observations in the British Isles from December, 1943, to November, 1944. GUNTON, H. C. *Quart. J. R. Met. Soc.* (*Phenol Rep.*), **71** (*No.* 54), 31 *pp.* (1945).—[See Abstr. 1207 (1944)].

551.508.5 307

Calibration and characteristics of a sensitive hot-wire anemometer. STEEVES, T. A., CHADDERTON, A. E., AND COOK, W. H. *Canad. J. Res. F.*, **23,** 192–7 (*May*, 1945).—A frame carries hot and cold Pt wires in the airstream, using a bridge circuit and a galvanometer as indicator. A battery supplies bridge current and another supplies the hot wires. Construction, calibration and tests are described. Accuracy is good at air velocities above 10 ft/min. Estimation is possible at speeds down to 1 ft/min, but it is not then independent of orientation and wind direction. E. H. W. B.

551.508.7 308

A dewpoint meter using cooling by expansion of CO_2. LIEPMANN, K., AND LIEPMANN, H. W. *Rev. Sci. Instrum.*, **16,** 36–7 (*Feb.*, 1945).

551.508.71 309

Humid hysteresis of Mahajan's optical hygrometer and others. MAHAJAN, L. D. *Indian J. Phys.*, **18**, 216–21 (*Aug.*, 1944).—The coercive time, residual humidity and humid hysteresis loop of hygrometers are explained. On traversing the path of a cycle of observations, the return path is different from the direct path, on increasing and decreasing the r.h. respectively. The cycle does not take the same path when repeated again. Its period is also reduced when it is repeated for some time without a break.

551.508.77 310

An intensity rain gauge. SIL, J. M. *J. Sci. Instrum.*, **22**, 92–4 (*May*, 1945).—An instrument recording intensity of rainfall against time on a daily chart is described. The rain is successively collected in one of three receivers over a period of 1 min; floats in these receivers operate a common pen arm. Performance figures are given; the instrument is sensitive to 0·02 in of rain per hr.

551.510.535 311

Recombination-processes in the E-layer of the ionosphere. WU, T. Y. *Terr. Magn. Atmos. Elect.*, **50**, 57–62 (*March*, 1945).—It is shown that photo-ionization of the negative ion of oxygen leads to a low value for the ratio λ of the concentrations of the negative ion and the electron ($[O^-]/[e]$). Hence the observed high value $\sim 10^{-8}$ cm^3/sec (compared with the theoretical value $\sim 10^{-12}$ cm^3/sec) for the day-time effective recombination-coefficient a' in the E-layer cannot be ascribed to a high value of $\lambda \simeq (10^2 - 10^3)$. In order to explain the observed a', a preponderance of + over − charge is suggested so that $[O+]$ or $[O_2+] \simeq 10^3[e]$. Night-time conditions in the E-layer are discussed. The rise of electron-density before sunrise is explained.

551.510.535 312

"Anomalous" behaviour of the F_2 region of the ionosphere. MARTYN, D. F. *Nature, Lond.*, **155**, 363–4 (*March* 24, 1945).—Seasonal and diurnal variations and the geographical distribution of the maximum electron density in the F_2 layer do not conform to the simple theory of solar ionization. Graphs are given showing the min. equivalent heights of the F_2 region for Washington (D.C.), Huancayo (Peru) and Watheroo and Canberra (Australia). The height variations in the N. and S. hemispheres are out of phase, showing maxima in midsummer; but the Huancayo graph resembles that for Washington when the sun is N. of Huancayo and that for Australia when the sun is S. It is therefore suggested that the anomalies are due to large-scale tidal movements in the ionosphere. A. HU.

551.515.2 313

Mobility of atmospheric vortices. SEN, S. N., PURI, H. R., AND MAZUMDAR, S. *Indian J. Phys.*, **18**, 311–6 (*Dec.*, 1944).—A discussion of the travel of a tropical cyclone. Recent observations of temperature over India suggest that the regions of double vortices are characterized by feeble horizontal gradients of potential temperature. A graphical method of forecasting the path of a tropical cyclone is given.

551.525 = 3 314

Soil properties. Results obtained from an investigation of soil temperatures. GEILHOFER, F. *Gas u. Wasserfach*, **86**, 236–43 (1943).—Results of a study by the Vienna Waterworks at 4 stations. Curves show air and soil temperatures, and comparison is made between the different stations. Temperatures at various depths (up to 3 m) are given as well as temperature variations from Dec. 1940 to Feb. 1942. The effects of changes of air temperature and the retarding influences of depths are considered. E. R. A.

551.576.4 : 621.383 315

Cloud heights and densities. HOUSER, P. H. *Gen. Elect. Rev.*, **48**, 7–12 (*April*, 1945).—A ceilometer is described with which cloud heights can be measured in daylight. A modulated light beam is projected vertically and the reflected light received by the ceilometer at a known distance from the projector. Special arrangements enable the modulated light to be detected even when the background light is as much as a million times as strong. The height of the cloud is calculated from the angle of tilt of the ceilometer when receiving the maximum amount of the modulated reflected light. For recording purposes the detector is oscillated continuously in a 12-min cycle from horizontal to vertical and back again, and the recorder associated with it gives a continuous record of cloud height and relative signal intensity plotted against time. Some particulars are given of the arrangements for eliminating stray 120-cycle pick-up and of the type of detector and amplifiers employed. A. W.

551.577.37 316

Intensity, frequency and distribution of heavy rainfall in N.S.W. MCILLWRAITH, J. F. *J. Instn Engrs Aust.*, **16**, 240–52 (*Dec.*, 1944).—A relation giving the intensity I of rainfall of duration t and frequency Y^{-1} is proposed in the form $I = Z(UY^{\beta} - S)/(t + b^m)$, where Z, U, S and b are constants, and β and m are coefficients depending on the station. Two methods of exhibiting rainfall probabilities are described: the first, most suitable for predicting low-frequency storms where the available observations are plentiful, involves plotting duration curves on logarithmic probability paper; in the second, which is suitable for less intense falls, the rainfalls are plotted against their probable frequency of occurrence in 100 yr. A combination of the 2 methods is used to exhibit Sydney pluviograph data extending over 84 yr, and the constants of the rainfall-frequency equation are derived. Records for about 60 stations in N.S.W. are similarly reduced, and mean equations, applicable to groups of these stations, are derived for prediction purposes. The effect of abnormally intense storms on predictions is briefly considered, and graphs are given showing how rainfall diminishes with increasing distance from the focus over different catchment areas. A. HU.

551.579.5 317

A rapid method for calibrating various instruments for measuring soil moisture *in situ*. KELLEY, O. J. *Soil Sci.*, **58**, 433–40 (*Dec.*, 1944).

551.593.5 : 535.247.4 318

Measurement of the photometric properties of the upper atmosphere. WALDRAM, J. M. *Trans. Illum.*

Engng Soc.; Lond., **10**, 125–30 (*June*); 147–87 (*Aug.*, 1945).—Visibility is affected by atmospheric conditions, especially scatter of the light and attenuation, the latter being a combination of absorption and loss by scattering. The scatter produces a veil of brightness over the object to be seen. The author describes measurements of these effects carried out in and from aircraft travelling at various heights, (*a*) in a clean atmosphere and (*b*) in the presence of industrial haze. For measuring scatter a polar nephelometer was used and this is fully described. For air to ground transmission measurements a telephotometer was used on the aeroplane. The results obtained are described in detail and discussed. J. W. T. W.

551.593.5 : 77.011 319

The scattering of light in the atmosphere. HARRISON, G. B. *Photogr. J. B*, **85**, 57–62 (*May–June*, 1945).—The mechanism of light scatter in the atmosphere is briefly discussed and the theory outlined. This theory is used to determine the visual range under various conditions of atmospheric scatter using simplifying assumptions. The conception is extended to calculate the "photographic range" under the same hypothetical conditions using various combinations of emulsion sensitivities and filters, from blue sensitive without filter to infra-red sensitive with infra-red transmitting filter. The figures so obtained are compared with published data and good agreement is found. No increase in range is obtained by the use of infra-red emulsions if the visual range is less than $\frac{1}{3}$ mile, and at a visual range of 20 miles the increase is only about 20%.

551.593.51 320

The "green flash" at sunset with a near "horizon." BARBER, D. R. *Nature, Lond.*, **156**, 146 (*Aug.* 4, 1945).

551.594.13 321

Evaluation and interpretation of the columnar resistance of the atmosphere. GISH, O. H. *Terr. Magn. Atmos. Elect.*, **49**, 159–68 (*Sept.*, 1944).—The columnar resistance of the atmosphere is defined as the electrical resistance of a vertical column of unit cross-sectional area extending from the earth's surface to a specified altitude. Considerable reductions in the fair-weather air-earth current over urban areas are attributed to enhanced columnar resistances over industrial districts. The conditions to be satisfied for the concept to be valid are stated, and methods of evaluating and analysing the columnar resistance are outlined. Possible interpretations of variations in the values observed are suggested. A. HU.

551.594.21 322

Mechanism of charge production in thunderclouds. CHAPMAN, S. *Amer. Phys. Soc.* (*Proc., July*, 1945). *Abstr. in Phys. Rev.*, **68**, 103 (*Aug.* 1 *and* 15, 1945).—Measurements of spray electrification showed negative and positive charges in the air in nearly equal numbers, negative predominating, but the charge ratio varied markedly with spraying or bubbling procedure. If the charge ratio approaches unity by the breaking drop mechanism of thunderclouds, another order of magnitude of charge is available. Thus breaking drops may provide the required charges of both signs in the air, which may be separated by the Wilson mechanism in non-turbulent regions of the cloud, yielding, as observed, a positive cloud top and negative cloud centre and bottom, except for a localized volume in the updraft region containing positive charge on the breaking drops.

551.594.22 : 621.317.31 323

The measurement of lightning currents in direct strokes. MCCANN, G. D. *Trans. Amer. Inst. Elect. Engrs*, **63**, 1157–64 (*Suppl. Dec.*, 1944).—[Abstr. 2525 B (1945)].

551.594.5 : 550.386 *see Abstr.* 292

553.982 : 550.83 *see Abstr.* 298

BIOLOGY 57/59

575.243 : 537.531.7 324

X-ray induced mutations in the physiology of *Ophiostoma*. FRIES, N. *Nature, Lond.*, **155**, 757–8 (*June* 23, 1945).

576.8.095.14 325

A growth-delaying effect of ultra-violet radiation on bacterial viruses. LURIA, S. E. *Proc. Nat. Acad. Sci., Wash.*, **30**, 393–7 (*Dec.*, 1944).—Filtrates of various bacterial viruses, all active on a common host, *Escherichia coli* B, were irradiated in thin layers (average about 0·02 mm) with u.v. light of about 80% of 2 537 Å. The radiation, besides inactivating the viruses, produced a delay in the growth of the surviving virus particles on a sensitive host; the delay increased with increasing doses of radiation. This effect is non-hereditary, and varies for different viruses. It appears to be due to the cumulative effect of the quanta absorbed by the virus particles before their inactivation. No similar effect was found on virus particles which had survived X-ray irradiation. For ionizing radiation, nearly each act of absorption by a virus particle is effective in producing inactivation; the surviving particles are likely not to have absorbed any radiation. C. J. G.

576.8.095.14 : 537.531.7 326

X-ray induced growth factor requirements in bacteria. GRAY, C. H., AND TATUM, E. L. *Proc. Nat. Acad. Sci., Wash.*, **30**, 404–10 (*Dec.*, 1944).—The bacteria (*Escherichia coli* and *Acetobacter melanogenum*) were treated with X-rays produced in a Westinghouse "Duocondex" unit containing an industrial type oil-cooled tube operated at 160 kV and 25 MA. Twenty-four- or 48-hour-old liquid cultures of bacteria were exposed to a total irradiation of 180 000 r units given at a rate of 4 000 per minute. Preliminary tests had shown that at this dosage over 99·99% of the cells were killed. The technique is described and the results discussed. The capacity of bacteria for carrying out specific biochemical reactions can be modified by X-ray treatment, and biosynthesis in bacteria would seem to be controlled by specific genes. C. J. G.

578 327

Calculation of the results of microbiological assays. WOOD, E. C. *Nature, Lond.*, **155**, 632–3 (*May* 26, 1945).

578.088.74 328

The orientation of pollen tubes of *Vinca* in the electric current. MARSH, G., AND BEAMS, H. W. *J. Cell. Comp. Physiol.*, **25**, 195–204 (*June*, 1945).—This study was undertaken to determine the effect of d.c. on the point of emergence of the pollen tube and its subsequent growth direction. D.c. caused germinating pollen tubes of *Vinca rosea* to emerge from the entine on the side toward the cathode to a greater degree than in other directions and to grow predominantly toward the cathode. Inhibition was reversible; cells showing no germination during exposure to the current may begin to germinate and grow normally within ½ hour after cessation of the current. No injury due to current was found up to 1 430 μA/mm^2 for 50 min. C. J. G.

591.175 : 778.3 *see Abstr.* 359

MEDICAL SCIENCE 61

611.77.087.86 : 536.532 *see Abstr.* 81

612.1 : 532.13 : 532.516 *see Abstr.* 33

612.11 : 541.18.04 *see Abstr.* 206

612.17 329

New basic concepts in electrocardiography: the ventricular gradient. BERG, W. F. *Nature, Lond.*, **156**, 590–3 (*Nov.* 17, 1945).

612.84 330

Human vision and the spectrum. WALD, G. *Science*, **102**, 654–8 (*June* 29, 1945).—The respective sensitivities of the receptors are modified by the coloured structures of the eye, i.e. the cornea and the ocular fluids. The present investigations deal with the spectral sensitiveness of the "aphakie" eye, i.e. an eye from which the lens has been removed as a result of accident, etc. The spectral sensitivities of the rods and cones have been measured for this type of eye and comparison with the other normal eye is stated to permit an estimate of the absorption of the lens and the pigment of the retina. The sensitivities of the rods and cones are related to the photo-sensitive pigments rhodopsin and iodopsin. The chemical constitution of the former is known and comparisons of absorption are given of this pigment obtained from human and (leaf) vegetable sources. Information of the iodopsin absorption, of unknown constitution, is still lacking. B. J. L.

612.85 331

Some experimental evidence for peripheral auditory masking. LOWY, K. *J. Acoust. Soc. Amer.*, **16**, 197–202 (*Jan.*, 1945).—From observations on anaesthetized cats, the electric response to the ticking of a watch gives a characteristic rhythmic record from the nerve and also from the round window. The response can be masked by pure tones of suitable but limited frequency range. The response is considered to be of neural origin, and the process of masking must occur within the peripheral organ. G. E. A.

612.85 : 543.773 *see Abstr.* 244

614.4 : 541.127.2 *see Abstr.* 190

614.71 : 536.423.15 *see Abstr.* 78

615.84 : 518.3 332

A nomogram for the evaluation of intermittent radon treatment. RUDINGER, G. *Amer. J Roentgenol. and Radium Ther.*, **54**, 78–9 (*July*, 1945).

615.84 : 518.3 *see Abstr.* 11

615.84 : 518.5 333

A slide rule for determination of dosage from linear radium applicators. RUDINGER, G. *Amer. J. Roentgenol. and Radium Ther.*, **54**, 72–7 (*July*, 1945).

615.84 : 539.185.9 = 4 *see Abstr.* 151

621.798.15 : 539.217 334

The kinetics of package life. OSWIN, C. R. *J. Soc. Chem. Ind.*, **64**, 67–70 (*March*, 1945).—The rate of change of the moisture content of goods packed in moisture-vapour-resistant wrappings may be expressed by $\tau = 69{\cdot}3R\mu/p$, where τ is the time in days required for the moisture content of packed materials to change from the initial value to a value which is the mean of the initial and equilibrium values. R is the package resistance (the mbs. aq. v.p. gradient required to change the moisture content by 1% of the dry weight of the contents in one day), μ is a const. characteristic of the material, and p is the aq. v.p. in mbs. at the storage temperature. Measurements show that this equation incorporates a safety factor of about 10 at 20°C, or 2·5 at 35°C, when R is based on laboratory measurements made at 40°C. [See Abstr. 3139 (1945)].

629.135 : 531.39 *see Abstr.* 21

655.3 : 539.501 *see Abstr.* 172

658 : 681.2 *see Abstr.* 349

GLASS . CERAMICS 666

666.1 335

Sealing and bulb glasses. *J. Sci. Instrum.*, **22**, 38 (*Feb.*, 1945).

666.1 : 539.16 *see Abstr.* 130

666.1.037.5 : 539.4.016 336

Glass-to-metal seals. REDSTON, G. D., AND STANWORTH, J. E. *J. Soc. Glass. Tech.*, **29**, 48–76 (*April*, 1945).—Photoelastic measurements have been made on standard sandwich seals over a wide temperature range by means of the stress–optical bench. Between room temperature and the annealing range for a seal the stress varied considerably and usually changed its sign. The stress at any temperature could be altered considerably by a change in the thermal treatment of the seal. Change of stress with temperature depended mainly on differential free contraction between glass and metal, but in the annealing range of the glass the

stress was modified by viscous flow. Where the metal had a low yield point (e.g. copper), the stress in the glass was much lower than that anticipated from differential free contraction. Axial stresses (p_z) were determined for bead seals at room temperature using the method of A. W. Hull [Abstr. 367 (1935)] and E. E. Burger; and the theoretical relationship between p_z and the ratio of the radii of the glass and metal components was verified. Hence the determination of axial stresses in seals could be used for rapid routine checks on the thermal expansion properties of glasses. It was concluded that the permissible value of the stresses in bead seals at room temperature depends on their design and application, and in some cases can safely be considerably >1 kg/mm² tension.

666.1.037.5 : 621.326.646.7 : 539.4.016 *see Abstr.* 169

666.1/.2 : 539.164 = 3 *see Abstr.* 137

666.113 337

Sealing glasses. DALE, A. E., AND STANWORTH, J. E. *J. Soc. Glass Tech.*, **29**, 77–91 (*April*, 1945).—They are classified according to their more important applications, and their dilatation, viscosity, annealing and d.c. resistivity characteristics are discussed. Information is included on the chemical compositions of the glasses and a classification is suggested, based on their contents of glass-forming oxides.

666.189.3 : 539.4.016 338

The strength of glass fibres. I. Elastic properties. II. The effect of heat treatment on strength. MURGATROYD, J. B. *J. Soc. Glass Technol.*, **28**, 368–405*T* (*Dec.*, 1944).—The value of Young's mod. and of the mod. of rigidity decreases as the fibre dia. is reduced; and the viscosity of the glass falls in value with the decrease in elastic moduli. Heating the fibres to 400°C causes increase in the mod. of rigidity, but not in Young's mod., and on heating to 520°C or higher, Young's mod. is increased as well as the mod. of rigidity. The viscosity of the glass is also increased by heat treatment. The author interprets the results as meaning that the process of drawing a glass fibre causes changes in the constitution. Long chains of molecules are formed lying parallel to the direction of drawing, and the lateral bonds between the chains are few. Heat treatment at low temperatures permits the formation of some lateral bonds. At the higher temperature levels, the chain structure should break up, but is prevented from doing so to the fullest extent by the dimensions of the very fine fibres. Heat treatment should also cause a reduction in strength due to the formation of strong lateral bonds and the consequent loss of "ductility." The effect of heat treatment on the strength follows the changes in the elastic mod. The strength is reduced to 70% of the original value by heating to 400°C for 30 min, and to 50% by heating to 520°C for the same period. Distribution curves of the breaking strains are compatible with a random distribution of flaws, which increase in number when the fibres are heated.

666.24 339

Coloured glasses. II. (*contd.*) The colour of glasses produced by various colouring ions. WEYL, W. A. *J. Soc. Glass Technol.*, **28**, 158–266*T* (*Aug.*, 1944).—The earlier section of this part [see Abstr. 2507 (1944)] dealt with the colours produced by Fe. In this continuation is discussed the colours produced by Mn, Cr, V, Cu, Co, Ni, U, Ti, W, Mo and the oxides of the rare-earth elements. In general, the nature of the colour, the chemistry involved, the reactions taking place and the properties of the glasses produced are discussed for each element. A. H.

666.24 340

Coloured glasses. III. The colours imparted by the non-metallic elements; sulphur, selenium, tellurium, and phosphorus and their compounds. WEYL, W. A. *J. Soc. Glass Technol.*, **28**, 267–354*T* (*Oct.*, 1944).—[See Abstr. 2507 (1944)].

METALLURGY 669

669.017.9 : 545.721/.723 *see Abstr.* 253

669.018 : 548.0 *see Abstr.* 264, 265

669.14 341

Local heating in plain carbon steels. Martensite formed from pearlite. WRAŽEJ, W. J. *J. Iron Steel Inst.*, 5 *pp.* (1945). *Advance copy.*

669.71.26 : 541.123.2 342

The constitution of the aluminium-rich aluminium–chromium alloys. RAYNOR, G. V., AND LITTLE, K. *J. Inst. Met.*, **71**, 481–9 (*Sept.*, 1945).—The solid-solubility curve for Cr in Al was redetermined between the peritectic temperature and 350°C, using micrographic methods. The results are in good agreement with those which Koch and Winterhager obtained by X-ray methods, and with the micrographic results of Fink and Freche above 530°C. The composition of the phase which enters into equilibrium with the primary solid solution was accurately established and corresponds to the formula $CrAl_7$.

669.71.72–175 : 532.612 = 4 343

Study of solidification grain size in Al–Mg light and ultra-light alloys. BASTIEN, P. *Rev. Métall.*, **37**, 181–91 (*July–Aug.*, 1940).—Progressive additions of magnesium refine the crystallization of aluminium during solidification, and similarly, additions of aluminium do the same for magnesium. Surface tension measurements show that this is clearly more pronounced in very pure aluminium than in aluminium containing magnesium, iron, or silicon in solution. From these data, the deduction may be made that surface tension probably plays a particularly important part during the initial phases of development of the crystallization centres, even when these have very small radii of curvature. An appendix contains a brief study of the rate of cooling on the crystallization of an aluminium-magnesium alloy. H. H. HO.

674.8 : 676 : 539.216 *see Abstr.* 155

676 : 620.172.224.1 : 539.4.011.2 *see Abstr.* 167

676 : 621.385.833 : 537.533.72 *see Abstr.* 96

676 : 674.8 : 539.216 *see Abstr.* 155

677 : 539.32 : 678.1 344

A comparison of some elastic properties of tire cords. WAKEHAM, H., HONOLD, E., AND SKAU, E. L. *J. Appl. Phys.*, **16**, 388–401 (*July*, 1945).—The elastic properties of 4 commercial and 5 experimental tyre cords are compared over wide ranges of loads, temperatures and moisture contents. The effect of temperature on elongations with various static loads is investigated, and the influence of moisture content on the results pointed out. The partial recovery and growth of rayon and cotton cords subjected to cyclic loadings are compared. A hysteresis test is described in which the energy loss per cycle of loading and unloading may be calculated. The results of these tests give considerable information concerning the possible behaviour of the tyre cord in the tyre.

677.31 : 539.216.1 *see Abstr.* 156

677.46 : 539.216 = 3 345

Recognition of super-molecular structure of cellulose hydrate fibres. SIEBOURG, H. *Zellwolle, Kunstseide, Seide*, **46**, 215–23 (1941).—Examination of cross-sections of fibres after treatment with $CH_3COOH + (CH_3CO)_2O$ (1 : 1) enables rayons to be identified. With viscose, the interior portion dissolves before the external portions. With Schwarza, Lanuso and cuprammonium rayons, all portions are attacked simultaneously. Fibres spun from the more dilute viscose solutions and those which have been subjected to the least degree of stretching, dissolve the more rapidly. J. G.

678 : 534.13 *see Abstr.* 48

678.1 : 539.32 : 677 *see Abstr.* 344

678.7 : 541.68 *see Abstr.* 235

679.5 : 539.501 *see Abstr.* 173

679.5 : 620.171 : 539.5 *see Abstr.* 171

679.5.04 : 532.13 346

The interaction of plasticizers and polymers. FRITH, E. M. *Trans. Faraday Soc.*, **41**, 90–101 (*Feb.*, 1945).—The general problem of plasticizer compatibility is discussed and it is suggested that a comparative measure of the compatibility can be obtained from experiments which measure polymer plasticizer interactions (w). Experiments are described which measure the viscosity of dilute polymer solutions in suitable mixed solvents containing the plasticizer in question. The slope of the (η_{sp}/c) *vs.* c curve is related to the equilibrium extent of swelling of the polymer in the pure plasticizer and the slope of the curve is a comparative measure of the compatibility. The effect of temperature and composition of the mixed solvent is discussed. The experiments are considered in the light of a previous theory of the effect of solvent on the η_{sp}/c ratio: the results do not support the suggested view that the slope of the (η_{sp}/c) *vs.* c curve is a simple linear function of w/kT.

679.513 347

Artificial bristles from proteins. MCMEEKIN, T. L., REID, T. S., WARNER, R. C., AND JACKSON, R. W. *Industr. Engng Chem.*, **37**, 685–8 (*July*, 1945).—A method is described for producing coarse fibres from casein by extruding a heated mixture of casein and water through a suitable die. When the fibre is stretched and hardened, under tension, with quinone, a bristle material is obtained, which is being tested in certain types of brushes.

679.56 348

Hot-forming of phenolic laminates. GUHL, H. C. *Mech. Engng, N.Y.*, **67**, 175–9 (*March*, 1945).

679.562.023 349

Low-pressure laminating. NELSON, J. D. *Paper Tr. J.*, **120**, *TAPPI Sect.*, 3–6 (*Jan.* 4, 1945).—The use of 50–55% phenolic plastic for cloth base and saturating paper laminates gives, at 100–300 lb/in^2 and 130–165° the best mechanical and physical properties without resort to the high-pressure laminating range. A strength increase of about 25–30% results on increasing the pressure from 65–70 to 300 lb/in^2, with only slight additional increases at higher pressures. The method has special advantages with intricately shaped parts, where lightness and strength are important. It also results in partial elimination of variations in laminating stocks, and produces high yields and low water-absorption properties. A fairly wide range of convenient techniques may be used, but the hydraulic membrane or rubber-bag method is usually preferred; the moulds can be made of low-strength materials, such as sheet metal, wood, concrete, plaster of Paris, or papier maché. J. G.

681.2 : 658 350

Suggestions for the reorganization of the instrument industry after the war. CLAY, R. S. *J. Sci. Instrum.*, **22**, 41–3 (*March*, 1945).

681.26 : 531.527 *see Abstr.* 29

PHOTOGRAPHY 77

77.011 : 551.593.5 *see Abstr.* 319

77.012 : 541.124 *see Abstr.* 184, 185

77.019 351

Luther's empirical rule and the quantum theory of exposure. SILBERSTEIN, L. *J. Opt. Soc. Amer.*, **35**, 301–6 (*April*, 1945).—It is shown that Luther's Rule (for the underexposed portion of characteristic curves) can be derived from the equations for these curves given by the quantum theory of exposure. A. H.

77.021.11 : 77.021.16 : 778.644 352

Dried emulsions in industry. With an account of the silk screen printing process. BAKER, T. T. *Photogr. J. A.*, **85**, 43–7 (*March–April*, 1945).—Discusses dried granular emulsions which are convertible to liquid emulsions by the addition of water. In the method described the emulsions are only partially digested and this is completed by the heated drying operation. Applications (e.g. coating metal surfaces by spraying) are described and an account is given of the anodizing

process for Al. The principles of the silk screen printing process are given in some detail. A. H.

77.021.16 : 778.644 : 77.021.11 *see Abstr.* 351

771.3 : 778.35 353

Air camera design. WILLIAMSON, S. *Photogr. J.B.*, **85**, 50–6 (*May–June*, 1945).—Considers modern requirements for war purposes and for peace-time surveying. Operational limitations such as haze, altitude, low temp. and humidity, vibration, drift and the effect of violent changes in velocity are discussed and current trends regarding choice of picture sizes, magazines, methods of holding the film flat, shutters, methods of simultaneously photographing relevant aircraft instruments, and lenses and their mountings are reviewed.

771.5 : 535.33 354

Photographic materials for quantitative spectrography. BARBER, D. R. *Engineering*, **160**, 257–60 (*Sept.* 28, 1945).—Surveys the more important factors to be considered in choosing photographic materials for industrial spectrography. The characteristic curve is discussed together with the changes which alterations in the conditions of exposure and processing can produce. Reciprocity failure is examined together with the effects produced by intermittent exposure. The connected problems of graininess and resolving power are also discussed at length. Some recommendations regarding microphotometry are made. Details of the new Kodak Uniform Gamma plate are given; this has an emulsion with a useful range of from 2 500 to 4 000 Å. Finally, the desirable characteristics of an emulsion for this type of work are summarized. A. H.

771.5 : 539.215.2 *see Abstr.* 154

771.53 355

Sensitivity distribution among the grains of photographic emulsions. TRIVELLI, A. P. H. *J. Franklin Inst.*, **239**, 101–13 (*Feb.*, 1945).—Application of Silberstein's quantum theory of exposure to the distribution of sensitivity in emulsions of pure AgBr shows that fog-corrected characteristic curves are divisible into 2 groups: symmetrical and asymmetrical. These are again divisible into simple and complex characteristic curves depending upon the type of sensitivity distribution among the grains. The nature of the emulsion's characteristic curves (simple or complex) depends upon development, and use of the first derivatives of the curves render possible the study of the sensitivity distribution among the grains. A. H.

771.534.531 : 535.33 *see Abstr.* 61

771.54 356

Studies in the sensitivity of photographic materials. TRIVELLI, A. P. H. *J. Franklin Inst.*, **239**, 269–84 (*April*, 1945).—Considers the expression of the sensitivity of photographic materials as deduced from the sensitivity of the individual grains. It is concluded that the sensitivity derived from the exposure required to produce a given density has no significance in the theoretical determination of the sensitivity of photographic emulsions. Values derived from the inertia have theoretical significance for simple characteristic curves, being quantitatively related to the exposures at the inflection points. The most complete measurements of sensitivity are obtained by a quantic analysis of the shape of the characteristic curve. A. H.

772 357

The influence of photographic developers containing hydrazine upon the characteristic curves of photographic materials. I. STAUFFER, R. E., SMITH, W. F., AND TRIVELLI, A. P. H. *J. Franklin Inst.*, **238**, 291–8 (*Oct.*, 1944).—Evidence is presented for a new phenomenon occurring under certain conditions during the development of silver halide emulsions in the presence of various hydrazine derivatives. Characteristics are increases in the inertia speed, *I/i*, and the contrast (gamma) as compared with those for normal development. A. H.

778.1 : 621.725 358

The production of photo-templates. COPPIN, F. W. *Photogr. J. B.*, **85**, 63–5 (*May–June*, 1945).—[Abstr. 185 B (1946)].

778.15 : 535.31 *see Abstr.* 56, 57

778.3 : 591.175 359

High speed linear photography. HARVEY, E. N., AND SICHEL, F. J. M. *J. Cell. Comp. Physiol.*, **25**, 175–9 (*June*, 1945).—A method utilizing a light source (d.c. carbon arc 15–20 A), a cylindrical lens and a photographic film moving rapidly and continuously in a direction perpendicular to the direction of the movement studied, is here used to record the change in width of living muscle fibre striations during contraction. It can be used with high powers of the microscope and is equivalent to taking over 1 000 pictures/sec. It may be adapted to record any changes in position of structures which take place in only one direction. C. J. G.

778.3 : 621.386.1 : 531.55/.57 *see Abstr.* 24

778.35 : 771.3 *see Abstr.* 352

778.644 : 77.021.16 : 77.021.11 *see Abstr.* 351